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# Electrical World

SEPTEMBER 21, 1940

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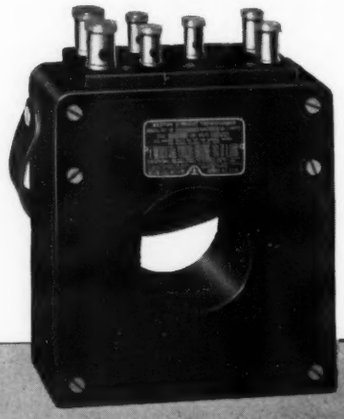
# Current Transformers



## ACCURATE AS THE MOST ACCURATE

## ELECTRICAL INDICATING INSTRUMENTS

While the Standard Type 1 WESTON Current Transformers have long been noted for their accuracy and broad flexibility, instrument users will quickly realize the advantages of the WESTON Type 2 transformer for precision work. (see red curves at right)

The extreme accuracy of these transformers is due to perfected structural details which permit full utilization of the high permeability of the nickel alloy core material, even at very low densities and at low burdens.

Thus when using WESTON Type 2 transformers there is no need for expensive, individual ratio and phase angle curves, except where laboratory precision standards are used. Testing is quicker, more convenient, less costly . . . and the possibility of calculation errors eliminated.

In addition, WESTON Type 2 Current Transformers offer the same broad flexibility as the Type 1. They are available in the following ranges:

| MODEL 461<br>Types 1 and 2 | MODEL 327<br>Types 1 and 2 |
|---|---|
| 10/20/50/100 Amperes self contained Primary; maximum of 800 amperes with Inserted Primary | 10/20/50/100 Amperes at binding posts; and 200/300/400/600/1200 Amperes with Inserted Primary. |

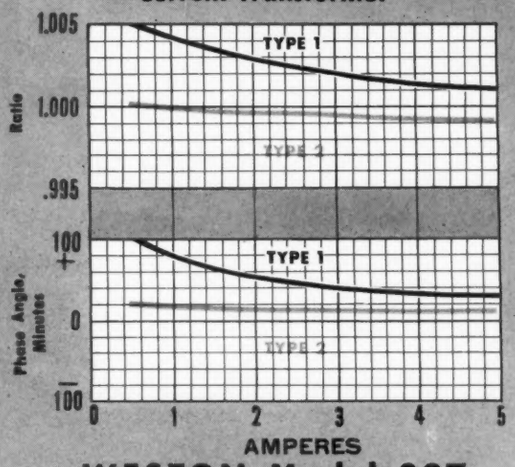
Full details on WESTON Current Transformers are available in bulletin form. Communicate with the WESTON agent near you, or write to Weston Electrical Instrument Corporation, 578 Frelinghuysen Avenue, Newark, New Jersey.

### TYPICAL ACCURACY CURVES

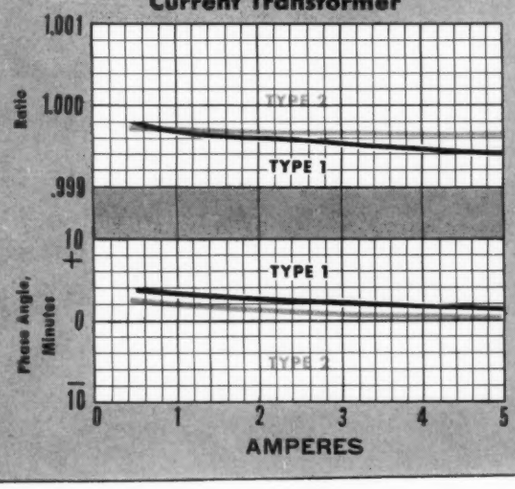
BLACK CURVES— Standard Type-1 Weston Current Transformer

RED CURVES— Type-2 Weston Current Transformer

**WESTON Model 461**
**Current Transformer**




**WESTON Model 327**
**Current Transformer**

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*September 21, 1940*

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| 8 | 35 | 49 |
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| 2 | 80 | 115 |
| 1 | 91 | 131 |
| 0 | 105 | 151 |
| 00 | 120 | 173 |
| 000 | 138 | 199 |
| 0000 | 160 | 230 |
| 250 | 177 | 255 |
| 300 | 198 | 285 |
| 350 | 216 | 311 |
| 400 | 233 | 336 |
| 500 | 265 | 382 |
| 600 | 293 | 422 |
| 700 | 320 | 461 |
| 750 | 330 | 475 |
| 800 | 340 | 490 |
| 900 | 360 | 519 |
| 1,000 | 377 | 543 |
| 1,250 | 409 | 589 |
| 1,500 | 434 | 625 |
| 1,750 | 451 | 650 |
| 2,000 | 463 | 666 |
| *Type RHT is permissible in sizes Awg 14-8 inclusive. | | |

Performite is the highest grade rubber insulation used on commercial building wire. The 1940 National Electrical Code permits Performite Type RH and Type RHT super-aging wires to be operated at 75° C. as compared with 50° C. for ordinary Type R wires. This means more capacity.

Performite Type RH wires, available with full insulation walls in all standard sizes, are recommended for general wiring. Performite Type RHT (small diameter) wires with 1/64 less insulation on sizes 14, 12, 10 and 8 can be used for general wiring and also for rewiring. When used for rewiring, the new code regulations permit the use of Performite RHT under conditions which greatly increase the capacity of existing raceways.

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# The Cloak of Defense

Development of large rivers is a public responsibility for the reason that many forms of public benefit may be involved, such as navigation, flood and soil erosion prevention, and irrigation, which, because of investment limitations to possibilities for reasonable return, might be denied the public under private exploitation.

The interesting question arises, therefore, as to which of all the public benefits is paramount and controlling. So far, in TVA, Columbia River and elsewhere, the generation of electric power has been declared to be a by-product, and on that basis the constitutionality of the government engagement in power transmission was determined. In other words, so long as the non-commercial community-benefiting programs of navigation, flood prevention, irrigation and water supply were the controlling reasons for the project, it was all right for the government to dispose of the by-product power.

Likewise, in the allocation of the cost of the development against the several beneficiaries, it was always possible to charge the lesser share to the by-product power. That this made it possible for government to set up rates lower than those levied by companies that had to charge all costs against that which produced the revenue was immaterial.

Now again comes the St. Lawrence. Time after time plans for developing this international waterway have been turned down, either because Canada didn't want it or because improved navigation of that river would be detrimental to the interests of the maritime cities. By assuming the lion's share of the cost President Roosevelt has secured Canada's acquiescence, and now it would appear that he is making a bid for the support of the Maine to Louisiana senators and representatives by coming out for a strictly power development of the St. Lawrence without reference to navigation at this time.

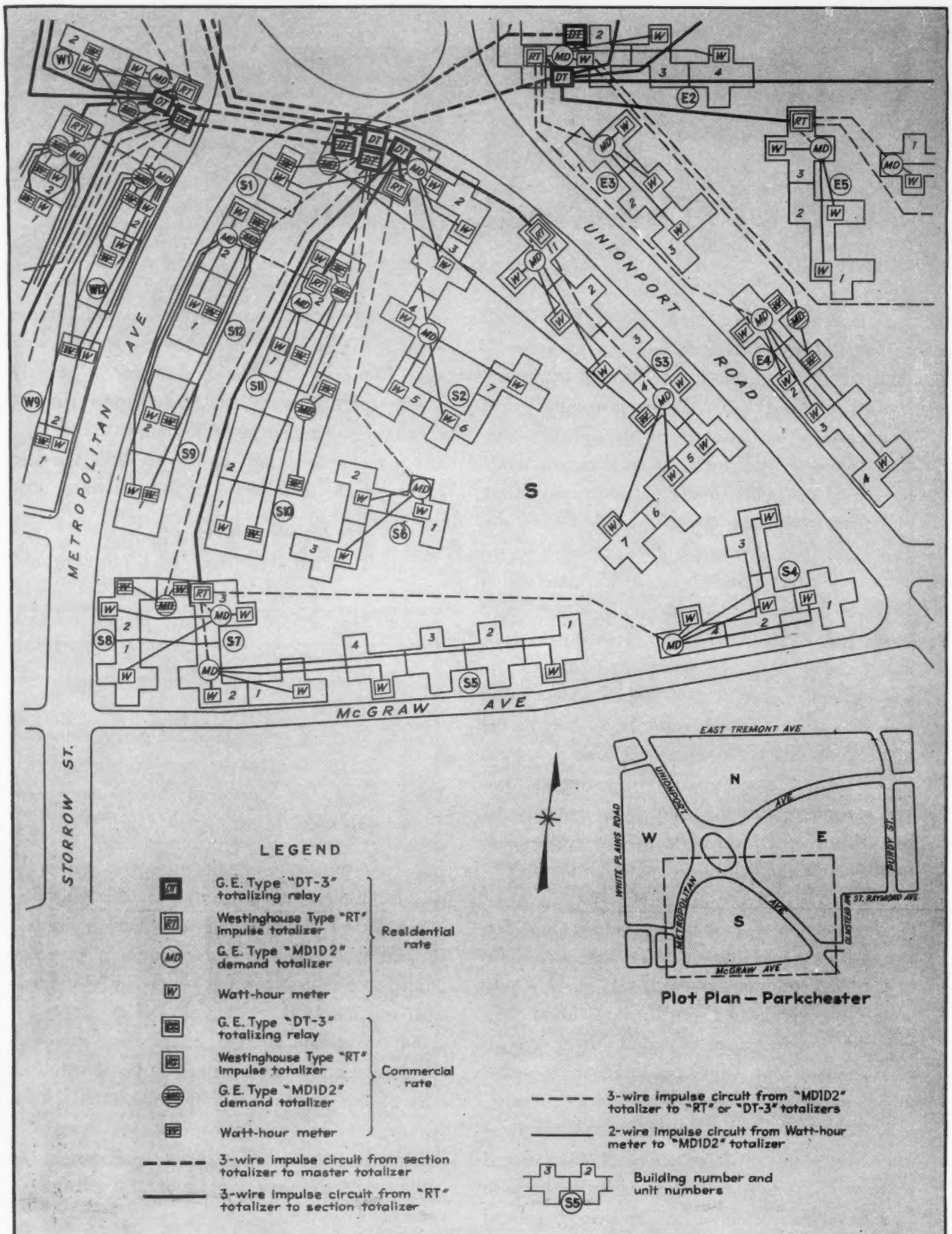
Defense program power needs is the peg upon which the President would hang this development in spite of the fact

1. That the area which such power would serve is now amply supplied.
2. That the St. Lawrence cannot be harnessed to produce power in time to be of much if any value to our national defense operations.
3. That the program of the government has so far been to locate war plants away from the Canadian border and the Atlantic.

It is unfair to saddle upon the American people in the name of National Defense more hundreds of millions of debt or unneeded projects just to satisfy a determination to press public ownership upon the people of New York and New England.

By no stretch of the imagination can the development of the St. Lawrence be of value to our defense program. On the contrary, by taking up space in already crowded factories working on utility orders it can delay the manufacture of power equipment that might be extremely valuable to national defense.

How can we expect the American people to get solidly behind our preparedness program when our leaders use it as a cloak to cover political projects?




Plot Plan — Parkchester

**COINCIDENT DEMAND METERING, now being installed in the 130-acre Parkchester housing development, involved 173 service points to be metered, 127 on the "residential" rate, 10 on the "commercial" rate and 36 on both; wiring layout for the south quadrant of plot shown**

# Demand Totalized for Housing Project

*Impulse wiring for both residential and commercial rates, terminating in single demand meter centrally located in 130-acre, 12,300-apartment housing development, permits coincident demand measurements for 173 service points*

*C. V. MOREY, *Consolidated Edison Company of New York, Inc.*

DEMAND measurement has been complicated by the widespread inclusion of demand clauses into utility rate structures. Under several of the service classifications of the Consolidated Edison Company, for example, assuming that certain conditions are complied with, a customer is entitled to be billed on the basis of the coincident maximum demand of a number of service points supplying the same premises.

A large-scale example of this type of coincident demand metering is being installed in the Parkchester housing development of the Metropolitan Life Insurance Company, under construction in Bronx County, city of New York.

### *A Complete Community*

This development, which is intended to provide living quarters for about 42,000 people, is complete from a commercial standpoint as to theatres, stores, restaurants, garages, etc. The major items of interest from an electrical distribution standpoint may be gained from the following approximate figures:

| | |
|---|---|
| No. of separate buildings | 60 |
| No. of building units | 180 |
| Height of building units (stories) | 6 to 13 |
| No. of apartments | 12,300 |
| No. of commercial establishments | 200 |

Throughout the area are located twenty-five 500-kva., three-phase transformer banks which are supplied by six high-tension feeders. The secondaries of these transformer banks form a part of the Edison Company's regular network distribution system at 120/208 volts, three-phase, four-wire. This distribution system supplies 173 separate services into the various building units and these services are metered by Edison Company meters at each point of entrance.

Two separate rate service classifications, both having demand clauses, are involved in the electrical supply. The supply for commercial establishments is submetered by the Metropolitan Life Insurance Company for separate billing to the individual customers, and for this reason it is not available to them on the same rate as the supply for residential customers, which is not submetered. No separate charge is made for either gas or electricity to apartment tenants, both being included in the rent. For ease of reference, the two electrical rates will be called "residential rate" and "commercial rate."

Of the total 173 service points to be metered, 127 supply energy for the residential rate only, ten supply energy for the commercial rate only and 36 supply energy for both residential and commercial rates. Where a single service is used to supply both rates, it is necessary to install two separate watt-hour meters. The number of watt-hour meters that are involved, therefore, is 163 for the residential rate and 46 for the commercial rate.

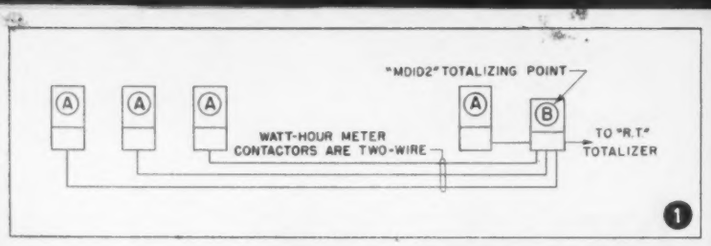
For each of these two groups of meters, the Metropolitan Life Insurance Company, in accordance with its privilege under the terms of the service classifications, chose to install impulse wiring in order that the coincident demand of all meters on each rate could be determined for billing purposes. If impulse wiring had not been installed, the total demand for billing purposes for each rate would be ascertained by adding the individual maximum demands of all meters on that rate. By the installation of impulse wiring for coincident demand advantage is gained of any diversity in load that might exist among the various service points on the same rate. In either case the energy charges would be determined by adding the registrations of all meters on the one rate for the billing period.

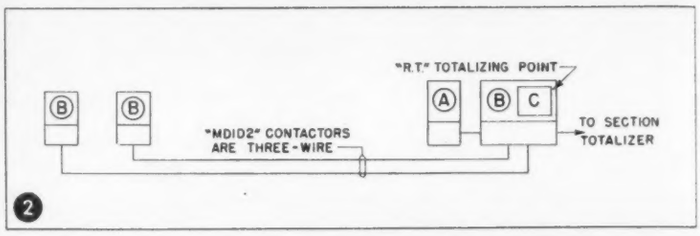
### *Checking Simplified*

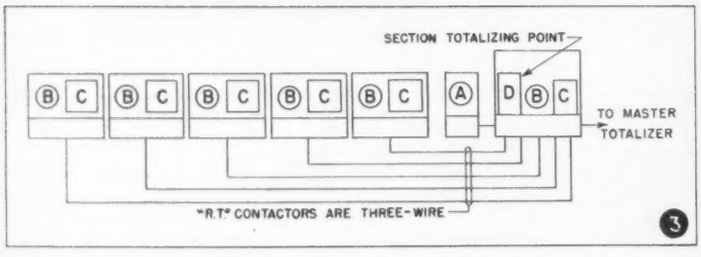
A color code was established for the impulse wiring to make it possible to trace wiring easily in case of trouble. In order to simplify the checking of demand impulses against total watt-hour meter registration the impulse outputs of small groups of meters (two to four, depending on conditions) are collected by sub-totalizing relays in close proximity to each group. In checking meter contact performance the distance between any meter and the first totalizing relay is thus kept to a minimum. It was not possible to run the impulse wiring over the shortest path between meters in many cases, particularly between buildings, since it was more economical in most cases to follow the route of tunnels constructed between buildings for steam mains, water mains, etc.

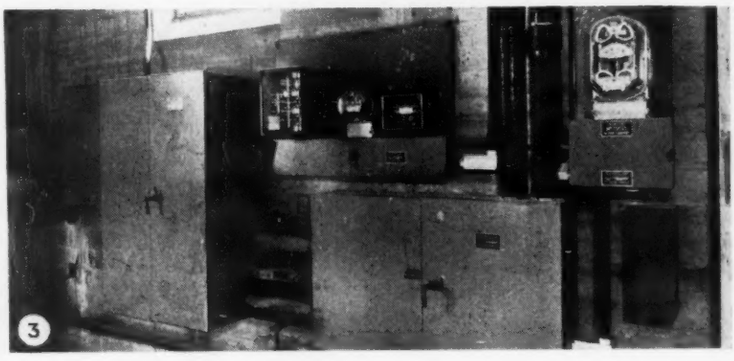
***Pictures and diagrams on the next page show details of impulse scheme by which demands in different service classes are totalized.***

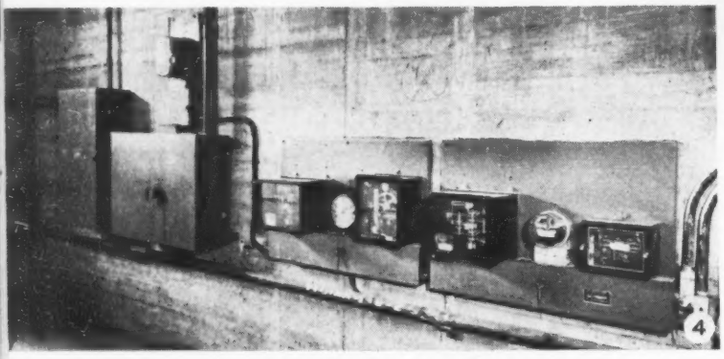
*Assistant meter engineer.

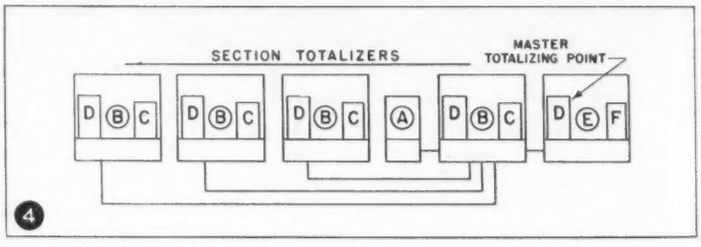





## SYMBOLS

- (A) WATT-HOUR METER.
- (B) G. E. TYPE "MDID2" DEMAND TOTALIZER.
- [C] WESTINGHOUSE TYPE "R.T." IMPULSE TOTALIZER.
- [D] G. E. TYPE "DT-3" TOTALIZING RELAY.
- (E) G. E. CONTACT MAKING CLOCK.
- [F] G. E. TYPE "PD-5" PRINTING DEMAND METER.

**DEMAND IMPULSE WIRING, terminating in a single demand meter at a central location, aids in determining the coincident demand of all watt-hour meters on both the residential rate (illustrated) and commercial rate for billing.**

1. Two-wire output contact devices attached to each watt-hour meter transmit one impulse for each 0.25 kw.-hr. Two, three or four watt-hour meters are connected to a four-circuit type "MDID2" totalizing relay* which is adjacent to the last watt-hour meter in the particular group. The relay is provided with a three-wire contact device and since the relay ratio is 2:1, it thus transmits one impulse for each 0.5 kw.-hr.

2. A group of three type "MDID2" totalizing relays transmit impulses at 0.5 kw.-hr. per impulse to a type "RT" totalizing relay which is adjacent to the last "MDID2" relay in the group. The "RT" relay is provided with a three-wire output contact device, and since the relay ratio is 2:1 it thus transmits one impulse for each 1.0 kw.-hr.

3. The total demand for each of the four geographical sections, north, south, east and west quadrants, is collected on a type "DT-3" totalizing relay. This relay is of four-circuit or six-circuit capacity, depending upon the number of "RT" relay groups in the section. A group of "RT" relays transmit impulses at 1.0 kw.-hr. per impulse to a type "DT-3" totalizing relay which is adjacent to the last "RT" relay in the group. The section totalizing is done as close as possible to the main master totalizing point for the entire project. The "DT-3" relay is provided with a three-wire output contact device, and since the relay ratio is 4:1 it thus transmits one impulse for each 4.0 kw.-hr.

4. At the master totalizing point, at the north end of the south quadrant, is located a type "DT-3" totalizing relay, adjacent to the totalizing relay for the south quadrant. This is referred to as the master totalizing relay and it receives impulses from each of the four section totalizing relays, each impulse, as shown above, equaling 4.0 kw.-hr. The output of the master relay, which has a ratio of 4:1, is transmitted through a three-wire output contact device, each final impulse equaling 16.0 kw.-hr. This final output is received by a type "PD-5" printing demand meter, which, operating in conjunction with a contact making clock, records the total kw.-hr. for each 30-minute interval of the billing period.

Since the demand is measured on a 30-minute basis, each impulse of 16.0 kw.-hr. assumes the value of 32.0 kw.-hr. for billing demand purposes.

*See details in item in New Engineering Ideas department, page 90.

# Performance Justifies Selection of Air-Blast Breakers

***Eleven "breaker years" of outdoor service from 138-kv. air-blast circuit breakers confirms utility's decision to adopt them after seven years research on all types***

***H. W. HABERL, Montreal Light, Heat & Power Consolidated***

THREE 138-kv. air-blast circuit breakers have been in outdoor service at the generating station of the Beauharnois Light, Heat & Power Company for eleven "breaker years." There have been fourteen automatic openings of breakers in service to clear short circuits and in every case the operation of the air-blast breakers was correct. These service openings in a number of cases were recorded by an automatic oscillograph set to record system disturbances and the oscillograms show an opening and clearing time of three cycles in service.

None of the interrupter contacts has required any filing or maintenance work and no work has been done on them. The insulation has been tested after several years of service and no deterioration has been detected; the atmosphere is very moist due to dense mist from the tailrace nearby.

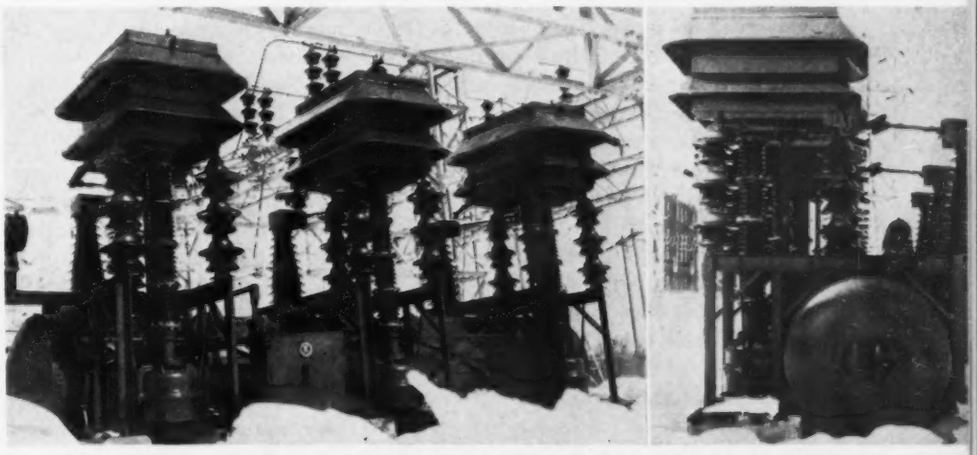
### *First Installed in 1934*

The first 138-kv. air-blast breaker was installed in 1934, following seven years of research by Montreal Light, Heat & Power Consolidated on oil-blast, water and air-blast breakers. This breaker was placed in service as a tie breaker between three 50,000-hp. generating units and two 115-kv. lines supplying 112,000 kw. to Montreal. It has six pairs of interrupting contacts (twelve breaks) in series per pole. The moving contacts are mounted on a vertical shaft of impregnated maple 6 in. in diameter, 48 in. long, contained in a rectangular insulating structure. Photographs of the interrupter at the instant of interruption show that the arcing is entirely inclosed and not visible externally. An automatic disconnecting switch is in series with the interrupter.

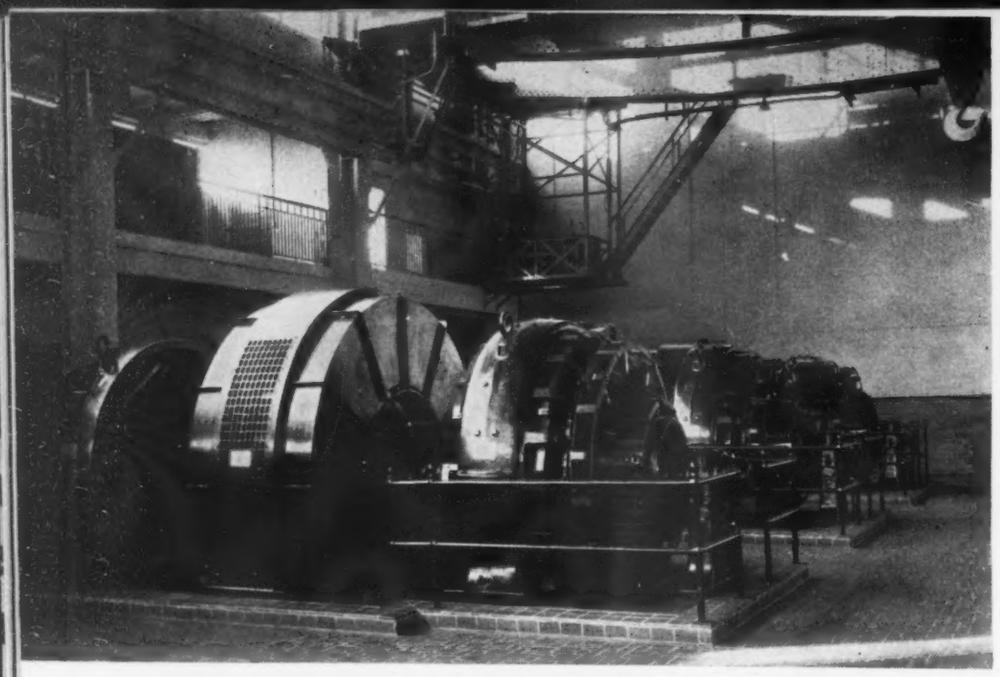
Compressed air at 90 lb. per sq.in. is taken from compressors in the power house used for other purposes. After passing through the usual aftercoolers at the compressors the air is passed through twin wool filters to remove the oil vapor and through twin dryers of activated alumina, removing moisture to a degree that prevents frost at temperatures down to 40 deg. below zero Fahrenheit. One of the twin dryers is reactivated by passing warm air through it while the other dryer is in service. One dryer serves several breakers.

During the first winter it was found necessary to shorten the period of reactivating to prevent frost; certain details of the disconnecting switch has to be changed for the high-speed operation and, for the same reasons, contacts of the 250-volt auxiliary switch had to be strengthened. The trip valve, which had a hard rubber seat, required a change in the grade of rubber. After four years of service it was found advisable to replace the electropneumatic valve which controls the disconnecting switch by a simpler

[*Continued on page 121*]



**OPERATING RECORD of 138-kv. air-blast circuit breakers justifies selection for Beauharnois station** This breaker, shown in side and end views, installed in 1940, differs only in improvements in detail from the three installed in earlier years. It has three moving contacts with six stationary contacts, making six breaks in series per pole. In series with the interrupter is the horizontally opening automatic disconnecting switch. Interrupter and disconnecting switch are supported on stacks of three standard switch insulators. Tests on the breaker show an opening time of three cycles. (Note—Photos were taken after heavy snowstorm of last winter which nearly snowed the breaker under, without causing any operating difficulties.)



THESE motor-generator sets for rolling mill stands have the automatic power factor and voltage control described

# Power Factor and Voltage Controlled Automatically

***Benefits accrue to both the supplier and industrial consumer — Practical limitation of power factor leads to premiums on power rates of the order of 5 per cent***

*E. G. SCHLUP,* American Rolling Mill Company, Middletown, Ohio*

AUTOMATIC CONTROL of power factor and voltage on industrial plant systems has been known for some time and all the writer desires to do in this article is to contribute the significant results of a successful installation. Also, it might not be inappropriate to suggest that inducements in terms of power rates should be more freely granted by power suppliers if more such successful installations of automatic control by users are to be encouraged. In this installation at the Middletown, Ohio, works of the American Rolling Mill Company the benefits derived may not result in as good a financial reward as the consumer desires, but credit has to be given to the attained voltage stability in evaluating the sum total of benefits. Managements and plant operating personnel will appreciate the extended life of electrical equipment, lower maintenance costs, increased safety and minimized interruptions which accrue from stabilized voltage.

That this automatic control intallation effected a pronounced improvement in voltage and power factor can be seen from Fig. 1. This improvement was obtained in the face of load fluctuating between 1,500 and 31,000 hp.; *i.e.*, from 9 per cent to 178 per per cent of rated capacity of the three 5,800-hp. synchronous motors, which drive d.c. generators serving the particular rolling operations.

A typical load cycle for a steel mill comprising an 80-in. hot and cold strip mill and conventional processing units is shown in Fig. 2. The rolling of steel from large ingots to strip steel passes through the following progressive cycles. Steel ingots of 20 x 57 in. cross-section and 17,500 pounds weight are first rolled into slabs of approximately 4 to 5 in. thickness and 74 in. width on a slabbing mill driven by a twin drive consisting of two 5,000-hp., 700-volt, d.c., 40 to 80 r.p.m. motors. Power for these motors is furnished by a 9,000-kw. flywheel generator set driven by a 7,000-hp., 6,600-volt, 60-cycle, 360-r.p.m. induction motor fed directly from the utility system. Excessive power surges on this motor-generator set are prevented by the application of a 100-ton flywheel and slip regulator equipment. The power peak load on the utility system of the above motor-generator set is approximately 30 per cent of actual power requirement of the mill.

After the slabbing of the ingot there follows a roughing reduction rolling under five 80-in. mill stands driven by 6,600-volt, 60-cycle motors. These motors range between 1,000-hp. induction type and 5,000-hp. synchronous type. The first half of the load cycle curve of Fig. 2 shows a partial effect of these motors. The spacing of these 5-mill stands, together with the rolling cycle of the steel, results in only one motor load at any time. After this roughing roll-

*Electrical engineer.

ing cycle there follows a finishing rolling under a six-mill stand aggregating 20,000-hp. connected load. Here the steel is in simultaneous contact with all six mill stands. These mills are driven by 600-volt d.c. motors which are fed from three motor-generator sets of 12,000-kw. total rated capacity. The motors driving the motor-generator sets are 5,800-hp., 6,600-volt, 60-cycle synchronous units fed directly from the utility system.

### *Automatic Control*

The automatic power-factor control equipment is installed on these 5,800-hp. synchronous motors. The load fluctuations on these synchronous motors, resulting from the power demand of the six finishing stands, range between 1,500 hp. and 31,000 hp., or approximately 9 per cent to 178 per cent of rated capacity.

Effect of load and excitation of one of these motors on the reactive kva. of the incoming line is shown in Fig. 3. Prior to the installation of automatic power factor control it was necessary to preset the value of the excitation such that unity power factor was maintained at a motor load of 178 per cent rated capacity. At this preset excitation and a motor load of only 9 per cent the reactive kva. component increases to several times its original value, resulting in violent fluctuations in leading power factor of 0.98 to below 0.70 (Fig. 1b) and voltage fluctuations of approximately 7 per cent (Fig. 1a) on the primary system. The secondary power distribution system of a large industrial plant, due to long feeders and excessive load surges, develops another additive voltage drop of 5 to 10 per cent, resulting in a total possible voltage drop of 12 to 17 per cent. Voltage fluctuations of this magnitude are obviously very undesirable from an operating standpoint.

That far superior operating conditions have been established by the automatic control is evident from the voltage and p.f. graphs in Fig. 1.

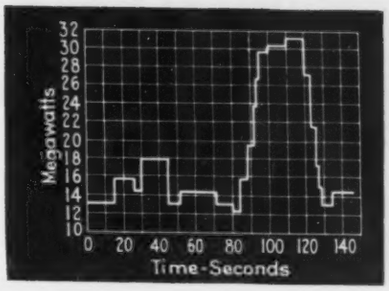



**FIG. 2—ROLLING LOAD creates sharp rise from 12,000 to 31,000 kw. This is what prompted the automatic control of voltage and power factor**

Originally these three 5,800-hp. synchronous motors were excited from a 250-volt d.c. constant potential bus which is maintained as an emergency excitation source for the automatic set-up. Required adjustment of excitation was obtained by means of individual motor-operated field rheostats in each synchronous motor field circuit. The desired automatic control of synchronous motor excitation could be effected by contactors acting to cut in or out successive steps of motor field rheostat resistance. However, this involves the frequent operation of contactors handling relatively large currents in inductive field circuits, resulting in considerable maintenance of the equipment. It was found advantageous to install a separate small exciter set for each synchronous motor, although it is possible to apply a large exciter set for all three synchronous motors. The automatic excitation circuit of these small exciter sets requires much smaller contactors than would be necessary for the excitation circuit of the 5,800-hp. synchronous motors.

### *Rapid Load Changes*

One of the significant features of Fig. 2 is the rapid increase in load from 12,000 to 31,000 kw. at the 90-second point of the cycle. This rapid increase in load is caused by the six finishing rolling stands aggregating 20,000-hp. connected load previously mentioned. During the short time cycle between 85 and 128 seconds, it is possible to roll 8.5 tons of strip steel of 74-in. width and 0.100-in. thickness at a delivery speed of approximately 1,200 ft./minute.

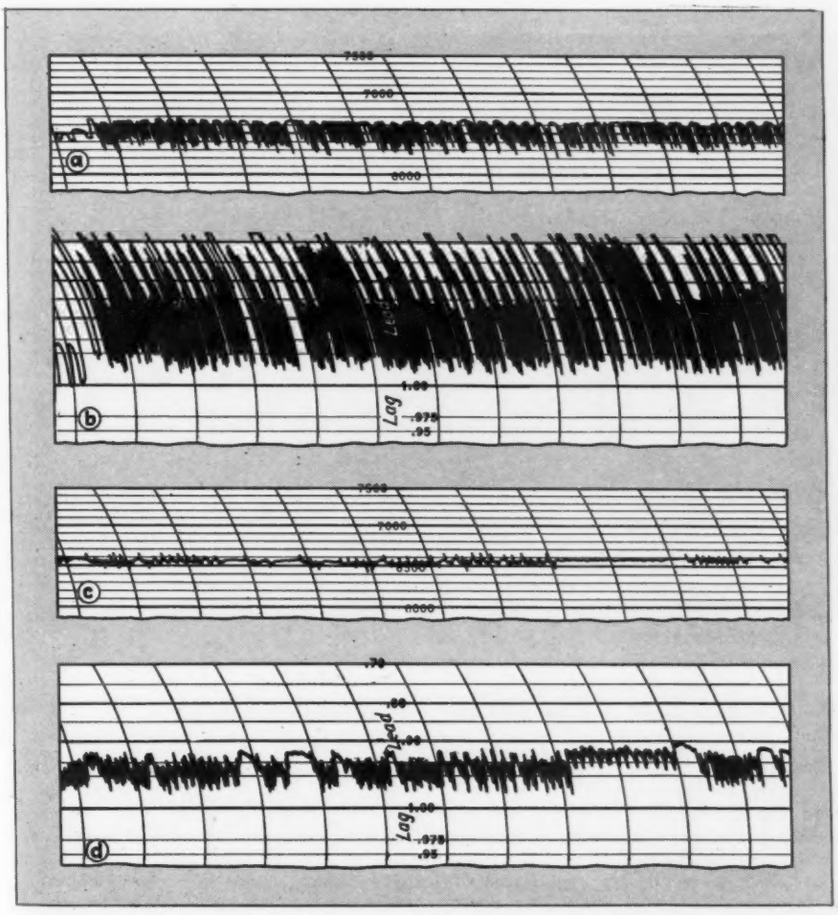



**FIG. 1—VOLTAGE stabilized and power factor substantially improved**

Before installing the automatic control—(a) The voltage ranged from 6,250 to 6,650 volts. (b) The power factor (leading) hovered between 1.0 and something less than 0.70.

After the installation—(c) The voltage range was reduced from 7 to 2 per cent. (d) The power factor now fluctuates only between 0.92 and 0.98 leading.

The rate of load peak occurrences can be fixed at possibly 25 peaks per hour. In order to maintain reasonably constant power factor on the primary system it is necessary to increase progressively the excitation of the 5,800-hp. synchronous motors with the rapidly increasing load.

### *Alternative Schemes*

There are two ways of appreciably increasing excitation with rapid load increases: First, a flag switch could be installed on the mill tables, reporting the approach of heavy load, and by time relay action the excitation of the 5,800-hp. synchronous motors could be progressively increased corresponding to the expected load. In this particular installation, due to a large variation in severity of power peak loads, it was found advantageous, however, to apply the second method.

This second method employs load "pick-up" relays installed on the generator side of the motor-generator set (Fig. 4). All generators are connected in parallel to a common bus, and it was felt safe to assume that the load division was sufficiently accurate that the load of any one of the six generators could be used to control the value of synchronous motor excitation. Three load relays are energized from the voltage drop across the compensating, commutating pole and differential series field windings, resulting in four steps of adjustment of synchronous motor field excitation. Thus, at idling friction load the load "pick-up" relays are open and the synchronous motors are excited at a value below normal rated excitation. The excitation value selected is such that the pull-out torque of the synchronous motors is approximately 140 to 150 per cent of rated capacity. This excitation current is approximately 70 amp. per synchronous motor.

It can be seen from Fig. 4 that the synchronous motors are 20 per cent overexcited during maximum load peak, but no excessive temperature rise of field winding resulted at the rolling cycle given above. This point, however, needs careful analysis for other duty cycles.

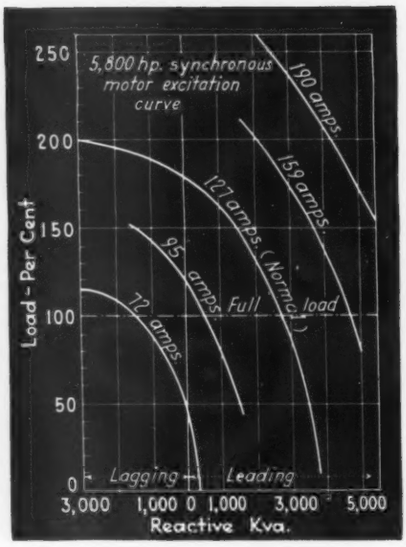
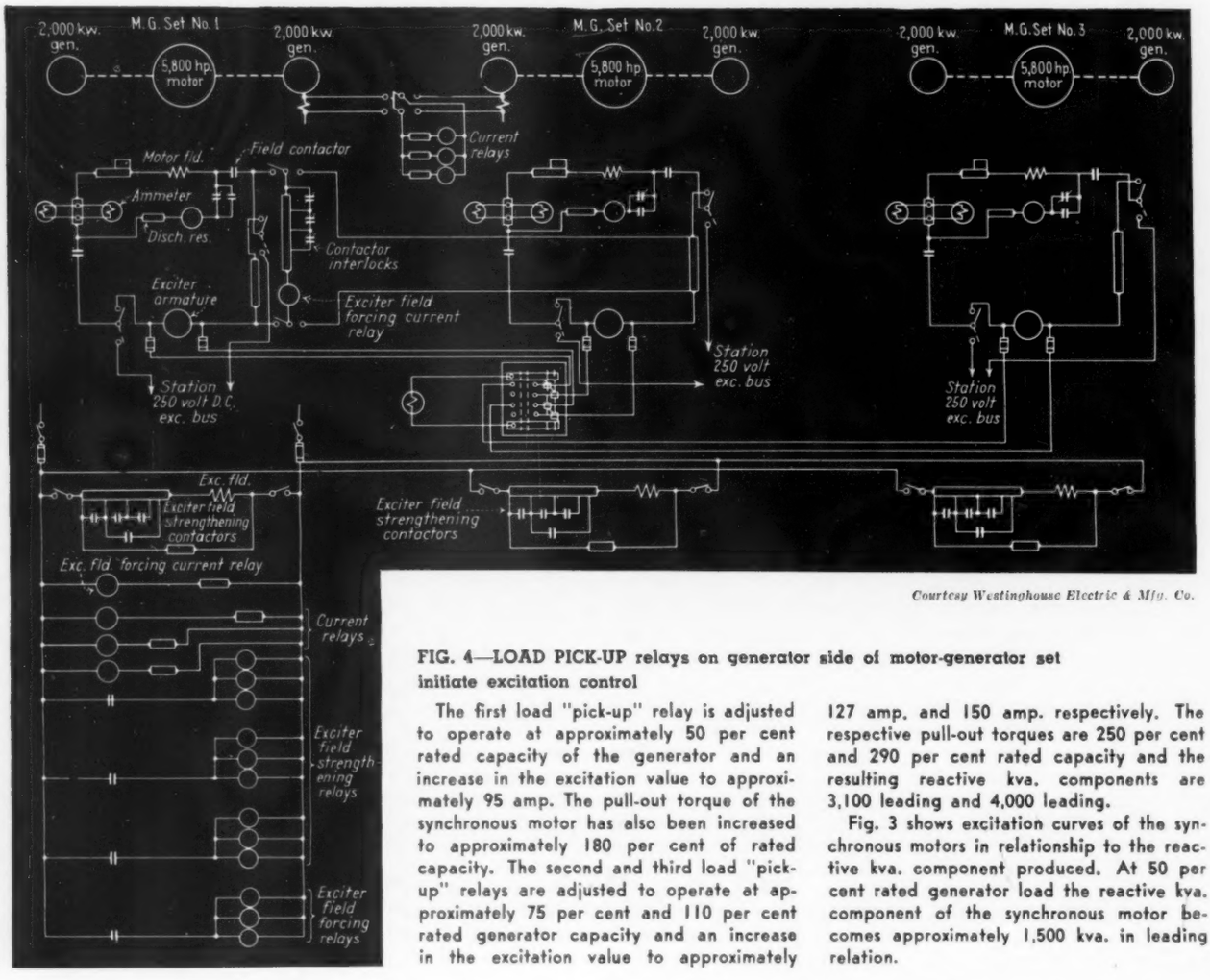



**FIG. 3—EXCITATION CURVES of 5,800-hp. synchronous motors. At half load the reactive kva. per motor becomes about 1,500 kva. leading with 95 amp. excitation.**




*Courtesy Westinghouse Electric & Mfg. Co.*

**FIG. 4—LOAD PICK-UP relays on generator side of motor-generator set initiate excitation control**

The first load "pick-up" relay is adjusted to operate at approximately 50 per cent rated capacity of the generator and an increase in the excitation value to approximately 95 amp. The pull-out torque of the synchronous motor has also been increased to approximately 180 per cent of rated capacity. The second and third load "pick-up" relays are adjusted to operate at approximately 75 per cent and 110 per cent rated generator capacity and an increase in the excitation value to approximately 127 amp. and 150 amp. respectively. The respective pull-out torques are 250 per cent and 290 per cent rated capacity and the resulting reactive kva. components are 3,100 leading and 4,000 leading.

Fig. 3 shows excitation curves of the synchronous motors in relationship to the reactive kva. component produced. At 50 per cent rated generator load the reactive kva. component of the synchronous motor becomes approximately 1,500 kva. in leading relation.

# Advertising Builds Good Will —and Good Business

PUBLIC RELATIONS SERIES

***Southern California Edison campaign publicizes municipal lighting developments, local municipal officials and itself through two-year campaign which builds load, supplies sales leads to company lighting salesmen***

SIMULTANEOUS promotion of municipal lighting load and good will is contained in an advertising campaign of the Southern California Edison Company appearing in *Western City*, a monthly publication reaching city and county officials in the company's service territory. Cities making outstanding use of sodium-vapor safety lighting, incandescent street lighting and recreational lighting are used in the series. A picture of responsible officials and their favorable opinion of the value of the lighting provide the foundation for development of the copy.

### *Builds Load*

"Results of this advertising campaign show it as our most successful method of helping to build municipal lighting load," states R. G. Kenyon, advertising manager of Southern California Edison. "Our street lighting engineers trace many of their leads to this promotion and it is given a sizable portion of the credit for the company's steadily increasing business in this classification. There is no doubt of the other phase of the value of the campaign —to promote good will toward the company. Cities are honored to be used in the advertisements and they appreciate the publicity given them."

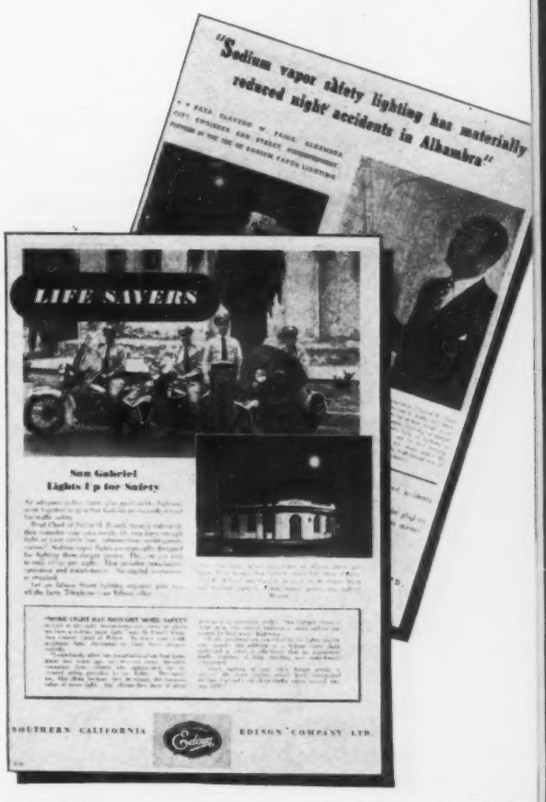
Sodium-vapor lighting to reduce traffic accidents at busy intersections, curves, underpasses and similar danger points has received the major emphasis in the campaign, which has been running about a year and a half under the direction of Mr. Kenyon. Accident records are quoted to prove the almost infallible manner in which sodium-vapor lighting reduces automobile accidents, and these, when given by an official of the city in question, are particularly effective. Mayors, city engineers, street superintendents, chiefs of police, fire chiefs and sheriffs are included in the group which has been used in the advertisements, which also show a night photograph of a lighting installation in the city.

In recent months several progressive cities in Edison service territory have improved incandescent street-lighting systems in main business sections for the purpose of increasing business, safety, civic pride, new construction and population. The success with which this has been accomplished has been headlined in Edison advertisements in the magazine, with the story being told by civic leaders.

In the summer the Edison company continues the testimonial approach, but shifts it to recreational lighting. Park superintendents, city engineers and recreational supervisors of various cities have stated in the advertisements that playground lighting is valuable in decreasing juvenile delinquency, increasing civic pride and providing facilities for adult recreation. Also shown are night pictures of one of the city's lighted tennis courts, ball fields or other recreational facilities.

### *Local News Story*

Each month a news story for the local newspaper in the town being featured is prepared by the Edison company concerning the use of the city in the company's *Western City* advertisement. These stories compliment the local city and its responsible officials for having such a fine lighting installation that the utility company has seen fit to use it as an outstanding example. This helps measurably to create a fine relationship between the utility company and civic officials, and incidentally enables the story of better lighting to be presented to the people in the particular cities in a manner which reflects credit upon responsible officials and helps them to further additional lighting improvements.


"Sodium vapor safety lighting has materially reduced night accidents in Alhambra"
LIFE SAVERS
San Gabriel Lights Up for Safety
SOUTHERN CALIFORNIA
EDISON COMPANY LTD.

**MAYORS, city engineers, street superintendents, chiefs of police, fire chiefs and sheriffs tell the story of safety lighting in advertisements sponsored by Southern California Edison Company**

# Protective Lighting for Industrial Plants

*Suggestions for types of units, sizes and location for line, fence and general yard lighting, as well as for special conditions and surroundings of yard*

*J. A. SUMMERS, General Electric Company, Nela Park Engineering Department, Cleveland, Ohio*

THE PURPOSE of protective lighting is to deter intruders from entering the property and to make them readily visible if they do enter. The amount of light and the type of distribution required to do this depend upon the importance and vulnerability to attack of the property and the other means of protection used, such as guards, fences and alarms. Each property must be studied to determine the places which are most vulnerable and then those places should be adequately lighted. No one system of lighting will take care of all cases, but one or more of the fundamental principles to be discussed can be applied to provide adequate protective lighting to meet most conditions.

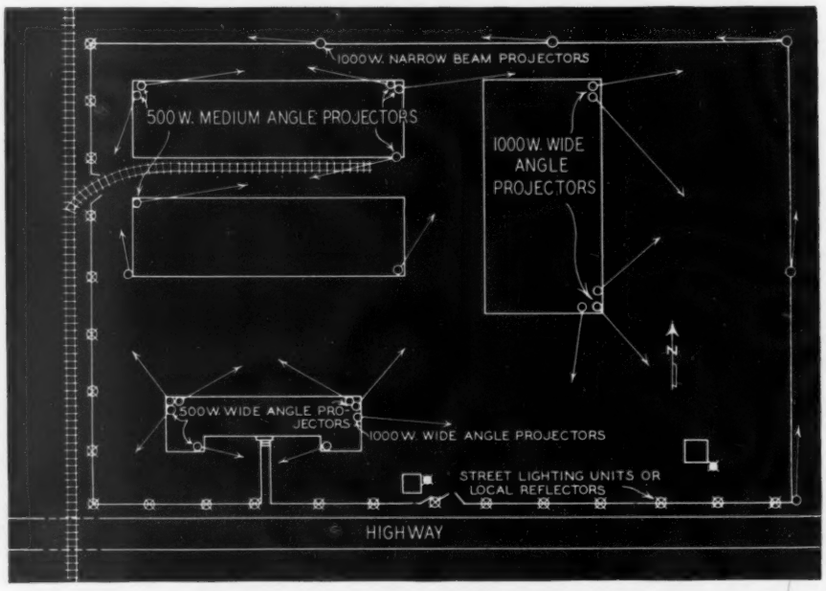
### *Light the Fences*

Protective fencing should be lighted because guards cannot see in the dark and a properly lighted fence not only reduces the number of guards required but simplifies patrolling. If guards are at fixed stations it is often feasible so to locate these stations that the field of vision of the guards is greatly increased. It is desirable where possible to have the guards located in shadow. The visibility of distant points is materially affected by the amount of light in the immediate vicinity of the guard. If he is standing in a lighted area more light must be provided at the distant point to provide equal visibility.

The conventional way of lighting a fence line is to place a narrow-beam 1,000-watt floodlighting projector at each corner and place additional projectors approximately 300 ft. apart. The projectors should all be aimed in the direction in which the guard is patrolling, so that the light does not shine in his eyes. However, local conditions, such as type of fence, location of the guard, method of patrolling, size of the yard, location of the building and surroundings of the yard, may make a different system of lighting more effective.

If buildings are close to a fence line it may be desirable to place the floodlighting projectors on the roofs of adjacent buildings and light the area between the fence as well as the fence. If there is a wire fence and the guard is patrolling inside the fence, it may be desirable to use a wider beam projector and direct most of the light outside of the fence so that the edge of the beam is along the fence line. This leaves the guard in relative darkness and provides a wide space outside of the fence in which he can observe any intruder. Such a condition is shown in the accompanying illustration. If the fence is opaque it should be painted white; thus an intruder will stand out in bold silhouette against the light background. In other places it might be possible to provide a light background, which would help the guard to see the intruder in silhouette.

In some cases, particularly in small yards, it is entirely feasible to light the fence line by means of local units


1000 W. NARROW BEAM PROJECTORS
500 W. MEDIUM ANGLE PROJECTORS
1000 W. WIDE ANGLE PROJECTORS
500 W. WIDE ANGLE PROJECTORS
1000 W. WIDE ANGLE PROJECTORS
STREET LIGHTING UNITS OR LOCAL REFLECTORS
HIGHWAY
N

**METHODS of protective lighting—For line lighting narrow beam projects where glare is not objectionable. Along highways or tracks street lights or local reflectors are advisable. An alternative to line lighting is general yard lighting from building roofs as shown**

spaced 50 to 75 ft. apart, using reflectors, refractors or standard street-lighting units. The units should be mounted high enough so that a passing person cannot easily reach up and hit the lamps with a club, thus putting a considerable section in darkness. It is necessary to place units close together so that there is no large area in darkness, thus providing a place of easy access for an intruder if one lamp is broken or burned out. Close spacing is also necessary to provide the coverage necessary to reveal intruders in fog and bad weather, when they are most likely to operate.

**USING a wide beam projector and directing most of the light outside the fence enables a patrolling guard to see any one who approaches, while remaining in relative darkness himself. Circle shows guard**

### *Eliminate Dark Spots*

Other vulnerable locations are: Spaces along railroad tracks and highways, narrow alleys between buildings, narrow spaces between buildings and fence lines, all entrances to yards, entrances to important buildings, areas where there is concealment, such as shrubbery or small wood, near to the fence line, and dead-end streets that dead end at the property line. If there are a number of freight cars parked in the yard, this is a location which should receive particular attention. Piles of lumber or stacks of other material around the yard may cause a shadow in which an intruder can lurk. In spots like this small fires may be started for the purpose of distracting attention from other locations where greater depredations are planned.

It is generally desirable to light the yard, or at least the most important areas. This lighting may be in addition to the fence lighting, in place of it, or in combination with it. Floodlighting projectors usually provide the most convenient and economical method of lighting, since they are available in many sizes with beam spreads to serve practically any condition needed; narrow beams for long distances and wide beams for short distances, and it is a simple matter to choose the type that will cover the area so as to light it to the desired intensity. The projectors may be placed on adjacent buildings where current is readily available to light both distant and close range areas, or on a single high pole strategically located and large enough to carry sufficient projectors to light a large area. A pole at the opposite side of the yard may be advantageously used to eliminate shadows cast by piles of materials.

Some of the various methods of lighting are shown in the sketch. This illustrates fence lighting and yard lighting of such design that each system may be used separately. As will be noted, the same results may be secured at some places by either method. When buildings are close to the fence the projectors may be placed on the roofs to light the fence and here they will be safe from being molested. Care must be used, however, not to cause objectionable glare outside the property line which may interfere with traffic or cause annoyance to neighboring residences. On the north and east side the sketch shows the fence to be lighted with 1,000-watt narrow-beam floodlighting projectors spaced 300 ft. apart and 20 ft. high. On the west and south sides 300-watt lamps are used in street-lighting units with refractors, and these are spaced 75 ft. apart and mounted about 20 ft. high.

Local units are used instead of floodlighting projectors because of the danger of glare to traffic on both the railroad and the highway. Projectors can be used at these locations, the same as on the north and east sides, providing care is used in so directing the light into the yard that the outer edge of the beam does not extend beyond the fence line. This method of lighting, however, is not as satisfactory as that just discussed because of the dark area which results between the fence and the railroad track or highway. The same principle applies to the projectors on the roofs of the buildings toward the railroad and highway. Unless the buildings are more than 40 ft. high, so that the projectors may be directed sharply downward, there is danger of trouble with traffic. These are the conventional locations for projectors used for yard lighting, but great care must be used when close to street or railroad.

### *General Yard Lighting*

If the fence lighting is omitted the yard may be lighted by placing 1,000-watt and 500-watt floodlighting projectors on the roofs of the buildings, as shown in the sketch. The number, size and spread of the projectors is readily determined by dividing the yard into sections that can be lighted from various buildings and measuring the area of each section and the angle to be covered from each location. By multiplying the area in each section by the foot-candles desired

[*Continued on page 63*]

# ELECTRIC COOKERY SOLD

*H. M. KEMMER,* Appalachian Electric Power Company, Huntington, W. Va.*

**REPRESENTATIVE** of thousands of commercial customers is this small restaurant, which increased its service entrance from 30 amp. to 100 amp. in two years, with almost a four-fold increase in usage

**SILEX EQUIPMENT** replaced gas equipment and coffee sales revenue increased from $11.50 per day to $30. Subsequently a 3.8-kw. tank model unit was necessary to handle production

THE FIELD of electric cookery can be opened up faster despite competitive fuel situations if we take pains to plan our sales approach. We must really know the specific customer's problems, his operating habits, his present equipment, his costs to operate and exactly where the job can be done better the electrical way. On top of all that, we must be prepared to pitch in and do the work ourselves once in a while, perhaps at rush hour, and we must call back and render service to be sure manufacturers' equipment keeps on doing the job.

Customer service of this type takes time, but it can be worth while. It results in new applications and uses for electric service, it increases load and revenue, it promotes satisfied customers, who, in turn, are the foundation of good public relations.

### *Analyzing the Customer*

In order to determine a customer's need for electric counter cooking equipment, a good plan is to patronize this customer. I make several visits at various times, even before making myself known to the customer or his employees. This practice furnishes me with a picture of his actual production, volume, service and the quality of his products, which is necessary before a successful approach can be planned.

Electric service facilities are noted, as well as existing lighting, refrigeration, seating capacity and arrangement, type of service, ventilation or air conditioning, electric energy consumption and cost, size and condition of all equipment, before planning the approach.

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*Adapted from first-prize-winning paper in council's national contest.

# AGAINST GAS COMPETITION

***Appalachian sells against 26-cent natural gas by detailed knowledge of customer problems and by step-by-step improvements through sale of heavy-duty equipment, counter equipment, lighting and ventilation***

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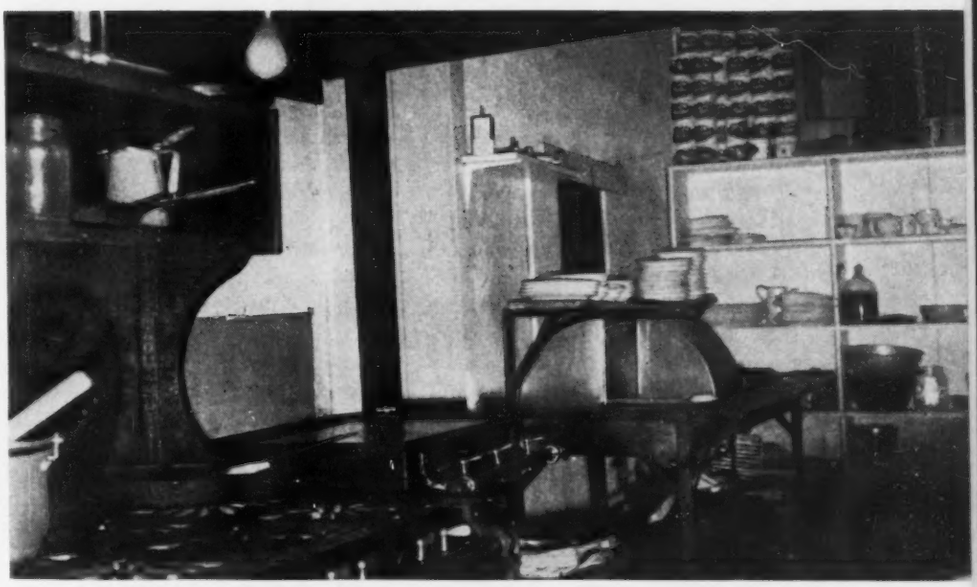
In a large majority of food service establishments the purchase of a cup of coffee will reveal the need for coffee-making improvement, and a study of menus will show the opportunities for recommendation of profitable items that can be produced only with modern electric counter equipment, such as fry kettles, grills, griddles, toasters, waffle bakers, coffee makers, soup kitchens and other labor-saving devices.

The majority of food service operators are favorable to constructive criticism of their products and service. By conducting a sincere study of operating problems and talking his language, the food service customer will always listen when increased net profit and increased sales volume are shown to be possible with modern electric counter cooking equipment.



**ONLY ELECTRICAL LOAD visible before conversion of this restaurant kitchen is a 40-watt bare bulb. The load jumps to 7,000 watts after conversion, due to installation of Hotpoint 2.6-kw. fry kettle, Hotpoint 1.65-kw. meat grill and 2.8-kw. food warmer using five 560-watt pans. On step-by-step plan, customer buys selection of portable counter equipment, refrigeration, ventilation, lighting and adequate wiring to serve the new loads**

### *History of Mr. B*

The case history of Mr. B. illustrates what can be done if this procedure is followed. In less than two years this customer's energy use has increased from a monthly average of 980 kw.-hr., with an average bill of $40.50 and a kilowatt-hour cost of 4.13 cents, to 3,472 kw.-hr. and $103, with decrease in kilowatt-hour cost to 2.9 cents. Kilowatt-hour consumption in 1938 was 11,812; in 1939 it was 25,852, and in 1940 it should exceed 42,000. Peak demand for the month is around 12.3 kw., with a connected load of electric counter cooking equipment of 21.6 kw. The prevailing gas rate is 26 cents per 1,000 cu.ft. The heat content of the gas is 1,150 B.t.u.

His small, 24-hour restaurant, with a seating capacity of 52 (including twelve counter stools), is located sev-

**STEP BY STEP the restaurant has bought electric counter cooking, electric heavy-duty equipment, new lighting and ventilation and motorized mixers and peelers, while the usage increased 3½ times**

eral blocks from the city's business district, at the intersection of an interstate highway.

His business was of the low-priced menu class—30-cent lunches and 40-cent dinners—with very little specialty production. A large volume of the business consisted of customers who demanded quantity and low prices. This class of business does not produce much profit.

His restaurant was inadequately lighted and ventilated; his counter design and location were poor for good operation; the back bar was not being used to its fullest advantage for profitable production, and an obsolete soda fountain occupied valuable floor space and returned no revenue.

### *Double-Service Entrance*

We first met Mr. B. in the summer of 1937. His 30-amp. electric service was inadequate for any additional equipment, so my first effort was toward increasing service facilities. Early in 1938 we were successful in having installed a new 60-amp. service.

Then we investigated cooking fat consumption, which was one barrel (450 lb.) per month. Pastry work absorbed 150 lb. of this, and the balance was used for cooking, principally deep fat frying. The cost of this latter work was approximately $52 per month. Estimating only 10 per cent fat savings per month, a modern electric fry kettle would pay for itself in one year.

This condition presented such an opportunity that we immediately displayed and secured approval for trial installation of an Edison 2.6-kw. fry kettle. The installation was made in December, 1938, and I handled one entire lunch production, fully demonstrating the kettle. This, incidentally, afforded me an opportunity to observe other operating conditions.

Permanent installation of the fry kettle was made in January, 1939. After a 40-day period it was found that a saving of 8 lb. of fat per day ($33.60 per month) was being effected, and increased electric cost was $5 per month.

The improved products so impressed the customer he asked that further study be made of his business.

Since good coffee is the backbone of any food service operator's success, we immediately directed our activities toward better coffee production.

Coffee was being made in a gas-heated, 3-gal. coffee urn. Raw coffee consumption per day was approximately 5 lb., which produced 50 cups per pound. The glass coffee maker demonstrated produces 75 cups per pound when the standard 2⅔-oz. package is used for each 12½-cup production. This increased production per pound of coffee means $1.25 more revenue per day for each pound of coffee used. Present coffee sales per day average 8 lb. This new method has increased daily coffee sales revenue from an average of $11.50 to $30 per day.

The installation proved so profitable that in December, 1938, we installed an additional 3.8-kw. tank model unit in order to handle the increased production and to improve service.

Observation of kitchen production revealed very poor working conditions—inadequate lighting and ventilation and poor arrangement of equipment for good and profitable production. We made complete plans for rearrangement of kitchen equipment and recommended the installation of a 1.6-kw. meat grill for steak and sandwich production. We also designed a new 2.8-kw. all-electric food warmer, which was made from an old gas-heated steam table in use. Recommendations were followed completely.

### *Lighting and Ventilation*

With the large increase in sales resulting from improved products, it became necessary to improve dining room service.

Complete plans and recommendations were submitted for rearrangement of back bar space, new lighting and improved ventilation, and the customer carried out the plans as recommended.

Then early in 1940 we designed a new counter and back bar and recommended installation. This was done and the obsolete soda fountain was removed and twelve additional seats installed.

Even with the few improvements made in 1938 and 1939 analysis of the 1939 business showed $305 increase in gross sales, $2,564 decrease in food costs, $1,446 decrease in labor cost and $341 increase in electric service costs.

We have stressed "out-in-front" operation and suggested new items of production, with the result that a 2.8-kw. toaster and a 3-kw. griddle were installed on the back bar early this year.

### *Labor Saving*

Labor-saving devices, such as a motor-driven mixer and motor-driven potato peeler were recommended and installed in the kitchen early this year. The customer states that the potato peeler has paid for itself, due to savings made in peeling.

Many non-electric labor-saving devices were recommended and installed, such as a potato cutter for cutting french fried potatoes, which

[*Continued on page 123*]

# Prevention Easier Than Cure of Radio Interference

*Practical construction rules followed in designing and erecting distribution lines will eliminate the common sources of radio interference which cause most trouble*

*L. V. BLAKE,* Arkansas Power & Light Company, Pine Bluff, Ark.*

WE BELIEVE that any distribution engineer who swaps one ounce of radio interference prevention for a pound of cure has made a bad bargain. But, fortunately, he doesn't have to abide by his bargain, for there are some simple rules which, if followed consistently, will result in construction of distribution lines essentially free from avoidable sources of interference. Our bargain-minded engineer can start his prevention program with his next line extension.

All the construction rules which can be laid down are corollaries of one simple, general rule which will keep sources of radio interference at a minimum.

*Connect all pole hardware solidly together, or keep it spaced well apart* —The corollaries are these:

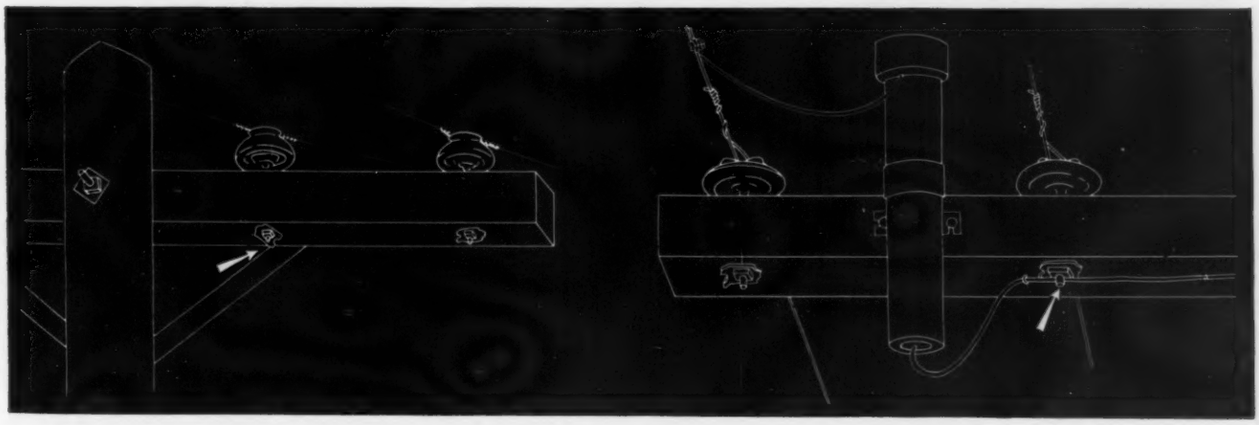
1. See that all hardware remains tight by periodic tightening.
2. Keep ground wires on poles clear of all ungrounded hardware.
3. Keep guy wires clear of all other wires and hardware.
4. Keep tie wires tight; on lines of above 5,000 volts avoid weatherproof insulation at ties and dead-ends.
5. In disk insulator assemblies use only standard type brass cotter pins.
6. Remove all pieces of "haywire" found hanging on line wires.

The explanation of radio interference caused by violation of these rules has not been given the attention it deserves. Briefly, it may be said that most important causes of radio interference are associated with the electrostatic field such as exists between any two conductors across which a voltage exists. Just as an electromagnetic field induces a voltage in conductors within its range, isolated conductors, such as line hardware, in an electrostatic field are subject to electrostatic induction. On an a.c. line a charge and discharge take place in such hardware exactly as in the plate of a condenser. Finally, if two units of hardware thus acted upon are *almost* touching, the intense field in the small gap may overstress and ionize the air at this point and allow the formation of a continuous arc. This explains the reason for the basic rule already given that: In constructing lines of 2,300 volts and above all pole hardware should be either solidly connected together or spaced well apart.

An inch or more spacing between units of hardware is sufficient, although it is well to instruct linemen to provide as much spacing as is consistent with good construction.

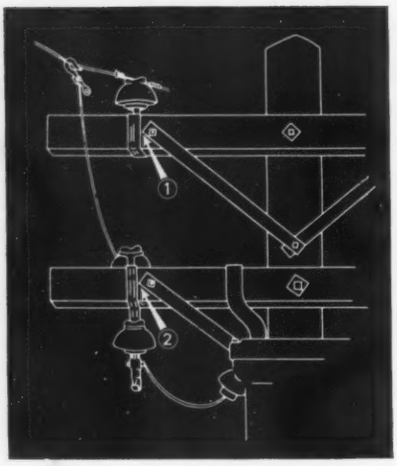
The accompanying sketches show a few typical conditions under which interference may, and often does, occur. Trouble of this nature is most frequently found on lines in the voltage region between 5,000 and 15,000 volts, although under "ideal" conditions the same trouble will occur in

*Radio technician.

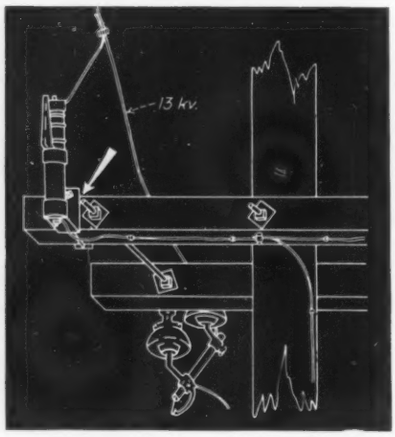


Washer on 13-kv. insulator pin too close to crossarm brace; keep all pole hardware spaced well apart

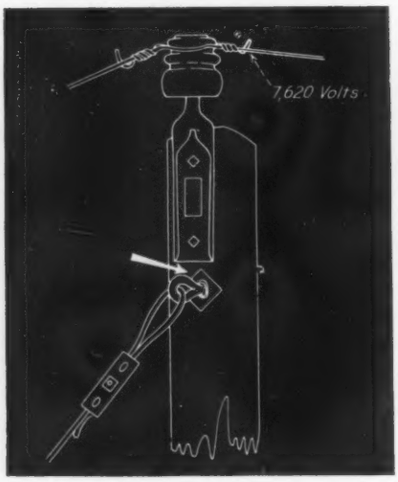
Arrester ground wire close to 13-kv. insulator pin; ground wire should clear all ungrounded hardware (rule 2)




**Insulator pin strap (or switch-mounting assembly) almost touching crossarm brace; connect all pole hardware together or space it well apart**




**Grounded lightning arrester mounting assembly too near spacer bolt washer (switch assembly on other end of bolt); keep grounded parts clear of all ungrounded hardware**




**Guy wire hardware almost touching metal pole-top insulator pin (rule 3)**

2,300-volt lines. Lines of above 15,000 volts are generally used for transmission rather than distribution—there is less hardware on the poles and, accordingly, fewer chances for this kind of trouble.

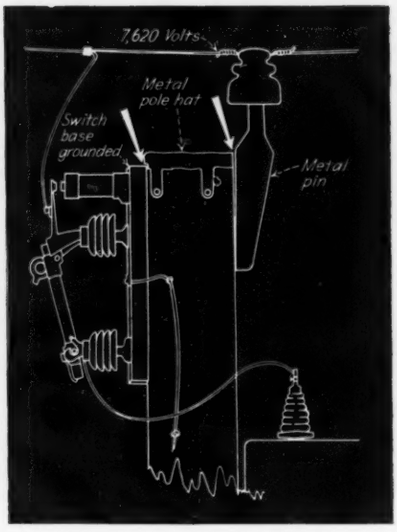
It is occasionally difficult for some linemen to understand exactly what occurs under conditions similar to those shown in the sketches. As a result, some may tend to laxity in observing the rule. Seriousness of radio interference will be appreciated, however, from the fact that in many cases radio interference caused by an arc between two units of hardware on a 13-kv. line has been found to affect radio reception of customers along the line ten or more miles from the actual source of trouble. Frequently, customers within a mile or two of such a source of interference cannot receive any programs whatsoever.

### *Watch Out For* ——

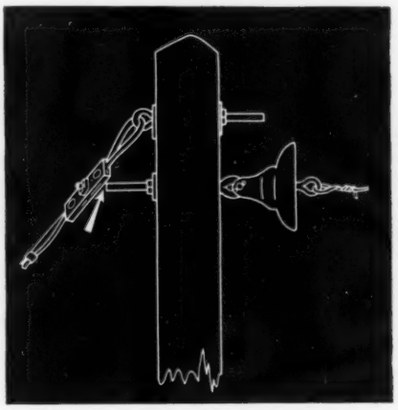
Discussion of the corollary rules laid down in the early part of the article may disclose some vulnerable points of construction which might otherwise be overlooked.

1. *Keep all hardware tight. Periodic retightenings are recommended* —Loose hardware is as frequent a source of radio interference as is hardware improperly spaced. If lagscrews, carriage bolts or throughbolts become loose a solid electrical connection may no longer exist between units of a hardware assembly. Arcing may therefore occur across the tiny gaps thus formed. Shrinkage of wood poles and crossarms almost inevitably results in loose hardware four or five years after a line is built. Loose crossarm braces are very often found to be causing radio interference. A periodical "tightening up" is about the only thorough remedy that can be suggested at present.

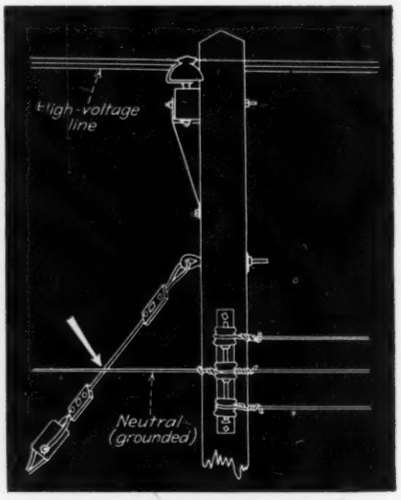
2. *Keep ground wires on poles clear of all ungrounded hardware*— This rule is often violated in connection with lightning arrester ground wires on transformer poles. Particular care should be taken to keep arrester grounds clear of such electrostatically charged objects as insulator pins and switch assembles, as well as crossarm braces, transformer hangers and metal "kickers." If weatherproof insulated ground wire is used staples should not be driven hard enough to crush the insulation. If bare ground wire is used staples should be driven tight. Staples within a few




**Metal pole top pin or switch base too near pole hat on 7,620-volt line; keep all pole hardware spaced well apart or connect it all together**



**Guy wire too near eyebolt; keep all guy wires clear of all hardware (rule 3)**

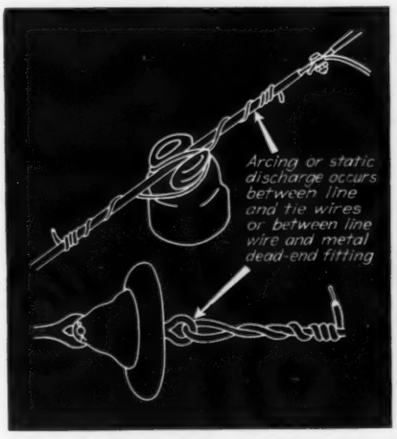



**Intermittent contact between guy and neutral wires; keep guy wires clear of all other wires (rule 3)**

feet of a high-voltage lead wire become charged, and will discharge to the ground wire if these rules are not observed.

3. *Keep guy wires clear of all other wires and hardware*—An ungrounded section of guy wire (the section above the strain insulator) becomes electrostatically charged and care should be taken to insure against guy and neutral wires touching or slapping together in windy weather.

4. *Provide solid electrical connection between line and tie wires*—This means *keep tie wires tight.* On circuits of above 5,000 volts, if the line wire is weatherproof insulated, the insulation should be removed at insulator ties and disk insulator dead-ends. If this is not done arcing or "spitting" will occur between the line and tie wires, especially after the insulation has aged a few years.




**Weatherproof insulator at insulator ties and dead-ends on lines above 2,300 volts; remove insulation at these points and use bare tie wire (rule 4)**

5. *Avoid the use of any metals which will rust or corrode*—Where rust or corrosion occurs good electrical connection no longer exists. Even such small articles as the cotter pins used in disk insulator assemblies are important in this respect—only the standard brass type should be used. Steel cotter pins or makeshifts should never be substituted. Electrostatic discharge to a rusted or corroded cotter pin will cause considerable radio interference. Metals which ordinarily will not corrode may do so when in contact with a different metal; this principle has, of course, been recognized and taken into account in the design of special devices for making connection between copper and aluminum conductors.

Recently considerable trouble was experienced at the ties on the neutral wire (grounded) of a 7,620-volt rural line. The conductor was stranded aluminum, the ties copper and the neutral support brackets galvanized iron. The cause was found to be "spitting" at some of the neutral wire ties; the lineman could hear the arc by placing his ear close to the tie. Removing the tie wire caused the radio interference to stop. This condition was occurring all along the line and was very difficult to remedy as it appeared to be due not so much to looseness of the tie as to corrosion formed by electrolytic action between the dissimilar metals. A detailed investigation of this condition has not yet been made.

6. *"Haywire" should always be removed when found hanging on high-voltage line wires*—This should be done even if it is on the neutral wire and cannot possibly swing into contact with other wires, as radio interference will result if such pieces of scrap are rusted.

### *Bothersome Interference*

In general, the most serious interference to radio reception will be caused by a discharge between two pieces of hardware when one is grounded and the other quite close to a "hot" line wire. These conditions are fulfilled, for example, when the ungrounded mounting assembly of a transformer primary switch almost touches the grounded mounting assembly of a lightning arrester, or when an arrester ground wire almost touches a steel insulator pin.

On the other hand, a discharge between two ungrounded pieces of hardware may cause *comparatively slight* interference. An example of this sort is the arcing that takes place between the two arms of a set of loose crossarm braces or between a loose insulator pin washer and the pin itself. Note, however, that *comparatively slight* should not be interpreted as *negligible.*

It may be of interest to mention here that radio interference caused by the type of condition being discussed may disappear in wet weather, or may come and go with changes in temperature. During a rain, water may form a temporary "bond" between closely spaced units of hardware, literally quenching the arc. Temperature changes may cause sufficient contraction or expansion of hardware to close a small gap or widen it, causing an arc to start or stop. Ordinarily, the size of the gaps across which these troublesome arcs occur is less than one-eight of an inch.

## Protective Lighting For Industrial Plants

[*Continued from page 57*]

the total lumens required in that section is determined. Dividing this by the beam lumens of the projector chosen will determine the number of projectors required. The procedure may be expressed by a simple formula: $\text{Number} = \frac{\text{Area} \times \text{Foot-candles.}}{\text{Beam Lumens}}$

After the number of projectors is determined, the next step is to select projectors that have sufficient spread of beam to cover the area with enough overlap of light to give reasonable uniformity.

As stated above, the projectors along the railroad must be carefully adjusted so as not to interfere with traffic, and if the distance to the tracks is too short or the buildings too low to do this properly the projectors should be replaced with local units, the size and type and spacing to be determined by the height of the building. The foot-candles required vary from 0.1 to 1 foot-candle, with the higher value recommended for the most vulnerable places and the lower value for those spots around the interior areas where the intruder is seen at close range. A general average of about 0.2 foot-candle is usually acceptable.

There are many small factories in congested centers where any considerable illumination outside the property line might be exceedingly annoying to neighboring residents. Such places can have adequate protective lighting by suspending projector flood lamps from the eaves and placing them on 10-ft. to 20-ft. centers.

Since protection is the main requirement of the lighting, due attention must be given to the wiring so that the lighting cannot easily be put out of service by simply cutting exposed wires. If exposed wiring must be used, make it a loop circuit. Where possible, it is better to place wiring underground or in rigid conduit so that it cannot be damaged easily.

# Distribution Outlays to Limit Lamp Flicker—I

***Appliance motor-starting currents create flicker limitations to transformer and wire loading which demand balanced load building to maintain economical distribution at lowered rates***

*D. K. BLAKE,* General Electric Company, Schenectady, N. Y.*

MODERN load-building equipment and devices may involve inrush currents producing sudden voltage dips that will require large expenditures to correct. This paper will cite examples of the limitations of modern distribution systems from the point of view of inrush currents vs. voltage dips. The investment imposed by these loads in order to confine the voltage dip within acceptable limits will be indicated.

It is, of course, impossible to estimate with reasonable accuracy the financial burden placed on the industry by inrush currents of some modern load-building equipments. It is evident, however, from the examples to be cited that the amount is of significant proportions, particularly when compared to the continually decreasing margin between cost to serve and revenue derived. Finally, those responsible for load building need to be apprised of the cost to design and build distribution systems to prevent these new loads from creating voltage disturbances.

### *Appliance Motor Starting*

By far the most common case encountered is the fractional-horsepower motor used with domestic appliances. Few people realize the magnitude of the investment in secondary systems to make them free from lamp flicker produced by motor-starting currents. Secondary system design in domestic areas is today largely determined by the amount of permissible instantaneous voltage drop attending motor-starting currents and not so much by the voltage drop resulting from the normal or peak loads. A consideration of Fig. 1 will clearly show why this is so.

In the first place more drop in voltage can be tolerated for the steady peak load, such as 5 or 6 per cent, than for motor-starting currents, such as 3 per cent. (In this paper 3 per cent instantaneous voltage drop, when not occurring as a periodic pulsation, will be accepted as the value that will give undisputed good service to any

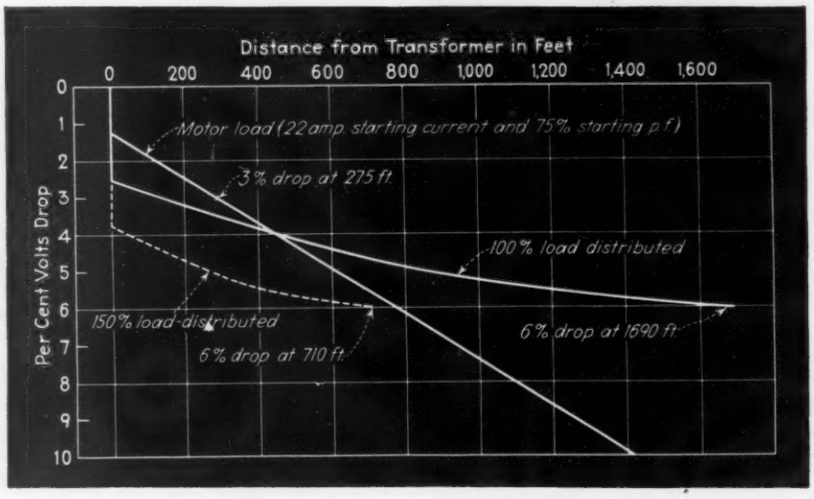



**Fig. 1—MOMENTARY and steady load-voltage drops through 10-kva. transformer and No. 2 secondary**

The curve for motor-starting current is the total voltage dip caused by a motor starting at the indicated current distances from the transformer. Observe that the steeper slope of the motor curve gives greater voltage dips than does the load current at a fraction of the permissible distance for 100 per cent transformer loading, and about equals the permissible distance for 150 per cent transformer loading. If as much voltage drop cannot be allowed for motor-starting currents as can be allowed for distributed load-voltage drop, it is obvious that permissible voltage dip is the limiting factor in secondary design for the load densities illustrated, and not the distributed load. For example, if the present load density permits full load on a 10-kva. transformer to be distributed a distance of 1,690 ft., but the motor-starting current dip is to be limited to 3 per cent, then the distance must be restricted to 275 ft.

In other words, the load density would have to increase from 3 kva./1,000 ft. to 18 kva./1,000 ft. before voltage dip would cease to be the limiting factor. On the basis of 150 per cent overload the similar range is from 10 kva./1,000 ft. to 25 kva./1,000 ft.

*Engineer of distribution system, central station department. A subsequent installment will deal with elevators, resistance welders and furnaces.

lighting load. Higher values obviously are permissible in many cases and, as will be shown, avoid considerable expenditures.) In the second place the peak load is distributed along the secondary, giving the consumers at the end of the line a voltage drop equivalent to about half that of the same load concentrated at the end, whereas the motor-starting current is effective throughout the entire length of the secondary. Therefore, the permissible voltage drop is less and the effective impedance greater for flicker design than for peak load design.

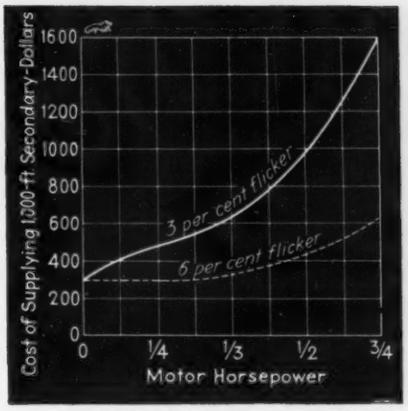



**Fig. 2—FLICKER limitations add to unit cost of secondary**

1. Costs of supplying 1,000 feet of No. 2 secondary (120/240 volts), limiting drop due to distributed load to 6 per cent and flicker drops to 3 per cent and 6 per cent using capacitor-type fractional-hp. motors. Load density 10 kw. per 1,000 feet.

2. If no utilization devices produced a serious voltage dip, the investment in a secondary system might be $300/1,000 ft. Investment increases at a rapid rate when the design is limited to 3 per cent voltage dip for the corresponding fractional-hp. motors. Investment curve flattens out as more voltage dip is permitted. This latter curve also shows the approximate investment for a 3 per cent flicker when adjacent transformer secondaries are tied together to form a banked secondary system. The lower curve is also the approximate shape of an investment curve using balancing coils at secondary extremities, but the entire curve would be raised an amount equal to from $75 to $100, the cost of the balance coils or auto-transformers. The economy of the two latter methods is very pronounced, even in view of greater operating expense not considered here.

### *Load Distance Curtailed*

Suppose that the present load density is 10 kva./1,000 ft. Then, as shown in Fig. 1, a 10-kva. transformer could feed about 700 ft. each way and carry 150 per cent load without exceeding a total of 6 per cent voltage drop. If, however, the design for flicker is limited to 3 per cent, the transformer can feed only 275 ft. each way. This would mean more transformers and shorter secondaries. After this money is spent it is obvious that the transformers will be underloaded to about 40 per cent of their load-carrying ability. It seems, therefore, that this fact is an all-sufficient reason for making a strenuous load-building effort in this particular location because the transformers and secondaries are all set to take about 2½ times (25 kva./1,000 ft.) their present load, as long as additional load imposes no greater starting currents.

### *Close Regulation Costly*

If, however, a 5.5 per cent instantaneous voltage drop can be tolerated the revenue-producing peak load determines the system investment and the motor-starting current imposes no financial burden. Every volt less than this, however, requires a substantial expenditure of real dollars that carries a load-building responsibility along with it.

One way of avoiding the financial burden is to adopt the practice of "banking" or tying the secondaries of adjacent banks together, because there is a big diversity between starting currents and because they divide two ways, giving about half the drop. Banking is quite often done at a very small expense, although the operating attention required is greater. An auto-transformer or balance coil connected across the three conductors at the secondary ends is also quite effective in reducing flicker. This method increases the cost nearly $100 per transformer when applied to both extremities of the secondary mains. It seems, therefore, that the secondary system design imposed by flicker voltage limitations challenges the ingenuity of those responsible for load building by requiring more detail attention to consumers on a specific secondary and concentrating on these until the load is built up to the point permitted by conditions of transformer heating or of secondary voltage regulation.

The foregoing example is based on a motor having a starting current of 22 amp. Larger motors, of course, make the situation much worse. Fig. 2

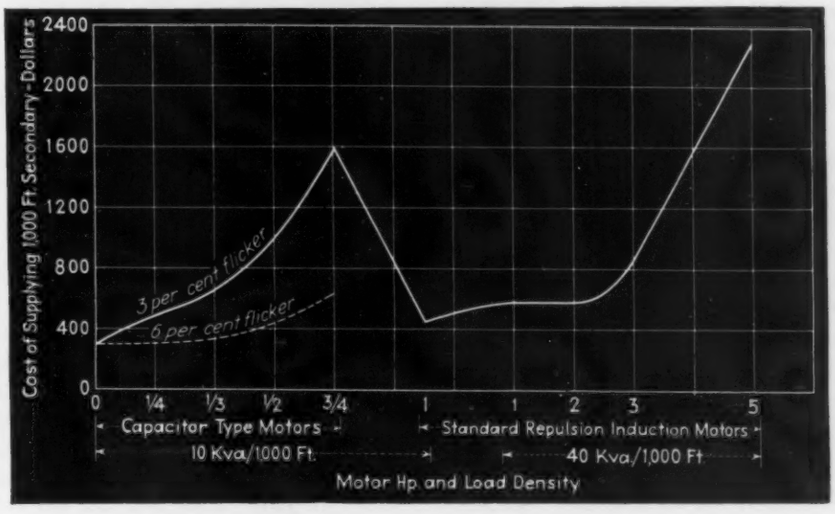



**Fig. 3—AIR-CONDITIONING motors and flicker**

Costs of supplying 1,000 feet of No. 2 secondary (120/240 volts) limiting drop due to distributed load to 6 per cent and flicker drops to 3 per cent and 6 per cent using capacitor-type fractional-hp. motors and standard repulsion-induction motors. Load densities 10 and 40 kva. per 1,000 feet as indicated. This curve is a duplication and extension of Fig. 2 to show the cost of supplying integral horsepower motors that have been considered for air-conditioning equipment in homes. Such motors would be operated at 220 volts, and that explains the sharp drop in the investment curve. The sharp rise at 3 hp. shows that a separate transformer for each consumer may be the best solution to motors 3 hp. and larger. The secondary system is also adequate, from the heating and normal voltage point of view, to supply a load density of 40 kva./1,000 ft.

It is clearly seen that the fractional-hp. motors above ¼ hp. could be served at 230 volts with very little additional cost to the secondary system, although it will increase the cost by an extra service wire and by the change to a necessary three-wire meter.

gives some indication of the relation between motor sizes and system investment as determined by flicker requirements. A similar curve should be prepared for specific systems and used in connection with load-building programs. It is obvious that load-building appliances utilizing 115-volt fractional-horsepower motors in residential areas make it exceedingly difficult to justify the investment required to give a flicker voltage less than 3 per cent. Such appliances must have a good load factor or else they should be accompanied by some high-load factor load such as water heater with off-peak control.

Fig. 3 is similar to Fig. 2 except with estimated extension to include integral horsepower sizes operated at 230 volts. This is an estimate made to indicate the pronounced effect of these motors on the secondary system investment as determined by a 3 per cent flicker limitation. The sharp bend of the curve at 3 hp. indicates the impracticability of larger motors except on a basis of individual transformers. Air-conditioning equipment in residences can use about 2 hp., with 3 hp. a possibility, but 5-hp. motors are definitely limited to commercial districts of fairly high density.

### *Load Diversity Helps*

Once a secondary system is installed to provide for certain motor sizes, most any number of similar motors may be connected without further expenditures because of the diversity between them. (There is, of course, an increase in the frequency of starting due to the greater number of motors, and this may in some cases require a smaller voltage limit than would be the case with a few motors.) It is, therefore, altogether necessary to co-ordinate load building with the correction of lamp flicker on individual secondaries.

### *Long Rurals*

The motor-starting currents on secondary systems are too small to cause any disturbance on the primary system in urban and suburban areas. However, in recent years rural lines have been extended to extremely long distances for the voltage used and constructed of small, high-resistance conductors, thereby making it possible for some disturbances to be experienced. The accompanying table gives some idea as to the length of lines that would give a 3 per cent voltage fluctuation. Fractional-horsepower motors are likely to give trouble only on 2,300-volt circuits, while at 7,200 volts a 5-hp. motor would give trouble only with the smallest conductors. Of course, such low-revenue-producing lines may not justify the expenditure to keep within a 3 per cent limit; 5 or 6 per cent may be quite acceptable in most cases and, therefore, greatly reduce the seriousness of motor-starting current disturbances as a limiting factor in rural circuit design. Increasing the permissible voltage dip increases the distance the line can be extended without exceeding that limit. Another consideration is that the larger motors would be used principally throughout the day.

**Allowance Lengths of Single-Phase Line for 3 per Cent Flicker on Lines Loaded with ¼-, 1- and 5-Hp. Motors**

| Conductor | Conductor Size | *2,400 Volt | | | 4,800 Volt | | | †7,200 Volt | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ¼ Hp. | 1 Hp. | 5 Hp. | ¼ Hp. | 1 Hp. | 5 Hp. | ¼ Hp. | 1 Hp. | 5 Hp. |
| | | Mi. | Mi. | Mi. | Mi. | Mi. | Mi. | Mi. | Mi. | Mi. |
| Copperweld | 4A | 21.1 | 10.9 | 2.9 | 84.4 | 43.6 | 11.8 | 189.9 | 98.1 | 26.5 |
| | 6A | 15.2 | 8.8 | 2.4 | 60.8 | 35.0 | 9.4 | 136.8 | 78.8 | 21.2 |
| | 3 No. 10 | 6.43 | 4.6 | 1.2 | 25.7 | 18.2 | 4.9 | 57.9 | 41.0 | 11.1 |
| A. C. S. R. | No. 1/0 | 28.5 | 13.4 | 3.6 | 114.0 | 53.6 | 14.5 | 256.6 | 120.6 | 32.7 |
| | No. 2 | 20.9 | 11.0 | 3.0 | 83.6 | 44.0 | 11.9 | 188 | 99.3 | 26.8 |
| | No. 4 | 14.9 | 8.7 | 2.4 | 55.6 | 34.9 | 9.4 | 134 | 78.6 | 21.2 |

* For 4,160-volt operation multiply these values by 3.
† For 12,500-volt operation multiply these values by 3.

### *Flicker on Rural Lines*

It is quite important to give careful consideration to lamp flicker before going too far with the extension of rural circuits of very small conductors. Otherwise substantial change-over expense may result from flicker complaints. There would be little difficulty in spending $100 to $200 a mile for larger conductors to reduce the voltage disturbance. This expenditure is required throughout the entire length of the line from the source to the point where the disturbance is objectionable. On a basis of three customers per mile, the per-customer cost for correction takes on its true significance. It is therefore desirable to see that equipment in farm load building resulting in expensive line reinforcement due to voltage dips is also accompanied by equipment consuming a substantial amount of kilowatt-hours.

Comparative studies made to determine the most economical primary distribution voltage should give due weight to the flicker characteristics as well as voltage regulation under normal load. While branch-line regulators increase the effective economic line length for a given voltage, they are of no value in the reduction of instantaneous voltage dips.

### *Networks More Tolerant*

The modern low-voltage a.c. network introduced serious lamp flicker problems by more general use of a common light and power supply system. At the same time it eliminated many difficulties with small motors because the large transformers and secondaries greatly increased the motor sizes that could be started at full voltage and thus save the consumer the cost of reduced voltage starting equipment. In many instances it is possible to start motors up to 50 hp. at full voltage.

Motors too large to permit full voltage or compensator starting are required by some operating companies to be equipped with increment starters to meet some such starting rule as 100 amp. plus 1 amp. for each kva. peak demand at ½-second intervals or longer.

# Improved Reliability for City Substation

*Step-type regulators on transformers supplying distribution substation bus replace individual circuit regulators and make space available for desired rearrangement*

*F. R. FORD,* Philadelphia Electric Company*

REPLACING induction regulators on individual distribution circuits with four air-blast regulators on the 13.2/2.4-kv. air-blast transformers at Ludlow substation eliminated a large number of smaller oil-filled units and provided space for rearranging the remaining circuit equipment to give increased reliability and ease of maintenance. A substantial credit was involved in the regulator removal, since many of these can be used to good advantage elsewhere.

The substation equipment is located in separate but adjacent buildings, with bus and control connections carried through the intervening wall. Two of the transformer banks are installed in each building and the circuits are divided approximately in accordance with the transformer bank capacity.

Many of the 2,400-volt circuits supply a low-voltage network in conjunction with 2,400-volt circuits from another substation. The step-type design of induction regulator, rather than the induction type, was indicated in order to avoid phase displacement and consequent unbalance in loop loading, since the associated substation has single-phase induction regulators on the individual network circuits. An alternate arrangement was to replace the present transformers with units in which step regulation would be incorporated, but this was found to possess no economic advantage, as well as to tie up investment in advance of actual need.

The Westinghouse step regulators are designed to give a regulation range of plus or minus 7½ per cent in a nominal 7,500-kva., 2,500-volt, two-phase, 60-cycle circuit in accordance with the rating of the transformer banks. Each bank has a rating of 12,000 kva. for four hours to meet emergency loading conditions and the regulators were designed for a similar performance.

**AIR-BLAST REGULATOR, one of four 7,500-kva., 2.5-kv. units installed on transformer banks at Ludlow substation, is 10 ft. high, weighs 7 tons**

Tap changing under load is provided by a dial switch in the series circuit with suitable circuit connections and disconnection through heavy-duty contactors operated from a motor-driven shaft. Interlocking between tap positions is done by Geneva gears with auxiliary switches to limit motor drive operation. Contact-making voltmeters control operation to give constant bus voltage of values selected by the setting of a control rheostat. Time delay is introduced on any regulator operation after voltmeter operation to minimize the action during momentary voltage changes.

A further feature of modernization at this substation is the replacement of one of two oil circuit breakers on the four 13.2-kv. outgoing lines with Deïon air circuit breakers. This replacement is in line with a program now nearly completed for the various urban substations.

Breakers on the outgoing lines are subjected to considerably more frequent tripping than those on incoming lines or on the transformer banks and the fault duty is relatively heavy. This is because of the reclosing procedure.

*Assistant engineer inside plant section.

# Editorials

S. B. WILLIAMS, *Editor*

## *Come-and-Get-It Rate Philosophy*

THE basic philosophy of public ownership, as expressed by its most vociferous advocates during the past several years, is about to be given its most severe test in Los Angeles. Give the public low rates, they say, and the load will take care of itself.

The Los Angeles Bureau of Power & Light has been operating on the basis of intensive promotion. A change in politics has placed the management of the bureau in different hands and the new-business department budget has been slashed, personnel sharply reduced and advertising appropriation lowered to a shadow of its former self.

Allegations that the bureau was becoming too great a political power would appear to be well founded, just from a glance at the size of the new-business department personnel. When compared with other operations of a similar size the number of employees appeared to be excessive.

If that were the reason for reducing the force no other comment would be necessary. However, to justify the slashing operations upon the theory that a publicly owned monopoly has nothing to sell, that low rates are all that are required to stimulate demand, is a horse of another color.

Low rates of themselves do not create demand. Time after time this has been shown. If the low-rate theory were correct, why does the Hydro of Ontario push sales so strongly, or REA with its large promotion department, or TVA or Seattle?

The experience last year of an Eastern power company with favorable rates located in a prosperous community was that out of every hundred sales calls only 3.2 were at the request of the customer. If the average were even twice as great the load mortality would wipe out growth.

The commissioners have the erroneous idea that they are operating a monopoly. After the local gas company has taken its toll of the electric cooking customers, perhaps it will dawn upon them that, after all, there is competition.

Likewise, this new economy wipes out support of the local electrical league, which it has taken years to build up. This league was the constructive non-political force that brought together co-operatively all of the local electrical interests. It has never been as easy to revive a league as it was to shut off its revenue.

The example of Los Angeles indicates clearly what we have said so often, that electric service is not the same as water or sewer service. If it is to help the customer the most it must be promoted, and energetically.

We are not opposed to public ownership because it is public, but simply because the underlying philosophy is not one of enhanced electric service. The incentive for profit, not present in public ownership, is what drives privately owned companies on to rendering an ever-expanding service.

## *An Accolade*

HEAVEN speed the day when we will not feel moved to write editorials like this. Hurry the time when the approving mention of an electrical utility executive in a labor newspaper is not an occasion for comment in ELECTRICAL WORLD, when such mentions are of common enough occurrence that they are read and passed over as ordinary and unremarkable.

But our times being what they are, it is a noteworthy phenomenon when one of labor's public prints gives a pat on the back to a utility boss.

Rockford, Illinois, had been in the grip of a 100-degree heat wave for more than a week. The weather broke with a violent storm that raised Cain with the overhead distribution system. The Rockford *Labor News*, August 1, 1940, described the long hours of hard and dangerous work of the union linemen by which service was restored to customers in double-quick time. At the conclusion of the news story—and a good story it was, too, written in vivid and action-filled terms that might have been employed to the great improvement of some utility publicity releases we have seen—it is related how Donald C. McClure, president of the Central Illinois Electric & Gas Company, stayed right on the job with the men until the storm damage was cleared and supplied them with plenty of hot coffee and sandwiches to help them keep going. Many electric utility head men have done as much or more in times of emergency, but so far as we know it is Mr. McClure who has the distinction of being the first whose devotion to duty has been recognized in the labor press.

The proportion of reasonableness and disposition to be fair is as high among the ranks of organized labor as among any other large group of men. Given cause and occasion, those decent human qualities will be manifest in amenities like this of the Rockford *Labor News*, which do more than most of us realize to help employee and employer to live and work together in amity.

(Since the writing of this editorial word comes of an advertisement in the printed program of Labor Day exercises at Macon, Ga. In this advertisement two labor unions praised the Georgia Power Company as an employer and commended its services to the public. Perhaps Heaven is speeding the wished-for day faster than we think.)

## Fair Play

CREDIT where credit is due.

On this principle of human conduct, a letter sent August 28, last, by Harry Slattery, Administrator of Rural Electrification, to members of four REA co-operatives in North Carolina is deserving of more than passing notice. The letter is a retraction of a charge made in an earlier communication that the Carolina Power & Light Company had constructed a "spite line." The company protested immediately and denied the allegation. Mr. Slattery investigated and found that his charge was unjust. It was based, he discovered, on "very incomplete information" in reports of field representatives made to REA headquarters.

There was no general rejoicing among electric utilities when REA started its activities. In its beginning attitude REA was frankly antagonistic toward the power companies. Through the reigns of administrators before Mr. Slattery that attitude was continued. Naturally, the utilities showed no overwhelming inclination to exude sweetness and light when they looked upon the doings of REA. But it was not long before utility men began to perceive the realities of the situation and to conclude that they had to live with it and should make the best of it. In many instances this resulted in active co-operation with, and assistance to, REA projects, and in general there has been observable a largely growing disposition among power companies to regard rural service co-operatives as neighbors and to live with them in friendly, neighborly fashion.

In his letter of August 28 Mr. Slattery refers by inference to this condition when he says that his "spite line" charge against the Carolina Power & Light Company "appeared to be substantiated by an examination of our files in Washington" and that "the files contain too much material on an earlier period when the company did oppose REA development and far too little" concerning the company's present policy.

One wonders if it would not be a fine thing for all utilities and REA to weed out from their files and burn all ill-tempered, anger-rousing, maliciously-written material. A good start on a new and happier set of records could be made with Mr. Slattery's letter of August 28.

## Fluorescent Foot-Candles

WITH incandescent lighting a foot-candle is a foot-candle, but with fluorescent it depends upon when the measurement is taken. In other words, values are higher upon installation and then fall off sharply for a short period when they become stable. We therefore have installed foot-candles and maintained or in-service values.

Because so much data are being circulated and will be used to sell future installations and to make comparisons, it would appear to be a matter of good policy to establish one or the other of these values as the standard. Because the in-service values are the ones under which the customer is going to operate most of the lifetime of the equipment this appears to be the most logical value.

Since fluorescent usage is growing at a healthy rate this is not something that should long be put off. Until it is decided there is going to be considerable confusion.

## Evaluation of the Lighting Load

WHILE the oldest and in many respects the most important load served by the utilities, less is known accurately about lighting usage of electrical energy than a great many lesser loads. This is due to the difficulty in separately metering lighting consumption.

Because of this situation estimates of lighting consumption and revenue must be based upon assumptions. Unfortunately these assumptions do not always reflect true conditions, being based too frequently upon insufficient data, or old data upon which each year's additions have multiplied the error, or upon inferences based upon dissimilar circumstances.

Statistics put out each year by E.E.I. showing the relative consumption of certain major domestic loads have had wide acceptance, but the lamp manufacturers insist that until these data are reconciled with the output of lamps and their known average life the data will show up the lighting load to a disadvantage.

The most important problem, however, comes in evaluating added lighting load. How many dollars is an added kilowatt of lighting worth? Where lighting load can be separated from other usages there is little difficulty in arriving at a reasonably true E.A.R. In residential lighting this cannot be done. Comparison of bills, while of some value, is no positive indication.

Some estimates for added residential lighting load run up to $25 and more per kilowatt-connected year. Others go down below $10. What is the right figure? Obviously it is not the same for all companies. Differences in rates, in class of consumers, in latitude, standard or daylight saving, make for dissimilarity, but not for the wide range that exists today.

It is possible that added residential lighting may return $25 a year per kilowatt-connected, but on the average this figure can probably be cut 40 to 50 per cent.

When a figure that is too high is used fictitious costs per dollar E.A.R. result. Obviously when the E.A.R. is lowered the unit costs will rise, but what of it? The result should not be any lessening of the effort to get this load, but, if anything, should bring plans to secure more of this load at no increased expense.

One suggestion that may have some merit would be to replace free of charge the first burn-outs of all new added residential lighting load. Thus, by knowing the average life of lamps and the time between sale and replacement, some data on hours use would result which would be fairly accurate.

E.A.R. isn't worth anything except it be reasonably accurate. To be otherwise would be kidding oneself, or, as they say, like "cheating at solitaire."

# This Curious Lull in the Attack

By CARTER FIELD

**This noted journalist gives his personal comments and interpretations on current happenings affecting the electrical industry. His background and his location at Washington make his thoughts informative and interesting even though all may not agree with him**

"VOLTS for Willkie" was almost a hymn of hate at the New Deal convention at Chicago which "drafted" FDR for a third term nomination. The left wingers harped on the "power magnates," the "grasping electric utilities" and "Wall Street domination."

Since then there has been a curious breathing spell. The New Deal bombers have been attacking other salients. You have scarcely heard about the wickedness of private enterprise since the New Deal put through the "conscription of industry" plan in Congress without one public word from Roosevelt on the subject. Of course there have been plenty of attacks on Willkie for having opposed this amendment, but these attacks have virtually ignored the utilities.

### *But Watch Out!*

There will shortly appear, it is reported, a pamphlet now being edited by the New Deal press agents attacking Willkie indirectly on this public ownership question. It will be comprised, the reports say, of quotations from various speeches made from time to time by Charles L. McNary, Willkie's running mate. The extracts, of course, are from arguments McNary made when he was trying, so successfully, to "bring home the bacon" to his Oregon constituents in the way of federal spending.

But isn't it strange that Henry Wallace, instead of hammering on the benefits his triple A program has brought to farmers, has insisted in concentrating mostly against Hitler? Of all people one would expect Henry to be most enthusiastic about public ownership of the electric industry. Henry is actually in favor, not only of that but of public ownership of both buying and selling. He would have community stores as well as cooperatives.

But he has not mentioned his views on this subject since he was nominated for vice-president. Perhaps he has been obeying orders, for it is not like Henry to keep quiet about a thing he fervently believes. But the censorship, if that is the explanation, would seem justified by expediency. There are a lot of storekeepers in this country, and most of them vote. So do their wives and relatives. Incidentally, quite a few of the big department store owners of this country happen to be very influential with a group on which the New Deal is counting heavily to swing the election, and which the New Deal regards as a group, despite various evidences to the contrary.

### *Wallace Under Orders*

But this would scarcely explain his silence—and the silence of all the other gunners directed by the New Deal fire control, if we may borrow the navy's phrase for the same thing, on the electric business. Wallace has special reasons for favoring the idea of turning every valley into a storage reservoir for electric power. It puts the most fertile land out of cultivation and thus aids his crop reduction program.

In fact, it is rather obvious that Henry is under orders to stress other issues, perhaps even to ignore this one.

Everything said up to now, of course, merely enlarges the question. Nothing has been said so far to answer it. The reason is that the writer does not know the answer and has not been able to find out what it is.

Yet when one remembers the comments, not only of New Dealers but of many Republicans throughout the country, who were afraid that the nomination of Willkie would land us in the middle of a crusade against the electric industry, it would seem that here is a question crying for an answer. Those fears seemed fully justified up to and through the Chicago convention. Since then—silence!

Even that desperate desire of some New Dealers to effect a grid system in the Northeast, as an entering wedge to complete federal domination of the industry, apparently has been shelved until after election!

### *No Popular Interest*

Is it possible that the various polls, taken since both conventions, have caused the Administration to doubt if the country as a whole is as much worked up against the electric industry as Roosevelt, Ickes and Rankin thought? Isn't it even more likely that the very shrewd scouts which the New Deal has roaming about the country, plus the intensive reading of newspaper editorials done for the White House, have shown a singular lack of interest on the part of the public in any criticisms of Willkie because he was head of a big utility holding company right up to the moment of his nomination?

Doesn't it prove, in fact, that the very skillful politician who is directing the New Deal campaign, to wit, Mr. Roosevelt, has decided that other issues are much more potent?

But don't run away with the idea that, if Roosevelt is re-elected, he will change his attitude toward the electric industry. The record is plain that the gentleman is very set, indeed, on that issue!

# NEWS OF THE WEEK

## Widespread Purge Hits Los Angeles P. & L. Bureau

***Control board moves to break up political power of bureau — Budget cut in half, Scattergood pensioned, 170 to 200 employees dismissed — Gas companies plan Blitzkrieg***

The social philosophy of public ownership of providing super-service to the consumer, to an extent and infinitude no private company could afford, has been followed by E. F. Scattergood in the operations of the Los Angeles Bureau of Power and Light. A violent shift from this philosophy to the ascetic one, which reasons coldly that having "a monopoly" there is no need to do anything to sell, that perhaps selling is "high-pressure" anyway and that low rates alone will bring increased use, is now taking place in the bureau.

This shift is now taking place with the purge of the water and power departments by the new three-that-vote-as-one commission. Mr. Scattergood, builder of the utility, has been pensioned off handsomely with a contract that ties his hands, it is said. The business agent's division has been reduced to the lowest common denominator, and on September 5 the board lopped off its support of the all-industry Electrical Development League of Southern California.

At the same meeting employee discounts on appliances were ordered abolished. The wiring allowance on ranges and water heaters was readjusted to give $20 on the first unit, $10 on the second, instead of the previous $40 and $10.

### *Gas Company Blitzkrieg*

Behind a bewildered and uncertain electrical industry which such a revolution has created, the gas companies of southern California have moved up preparations for a Blitzkreig fall gas range drive to take back to gas the hard-won progress toward electrical usage of the past ten years. With a 20 per cent trade-in allowance on old stoves on their side, and the now increased differential on electrical ranges due to decreased wiring allowance, and with electricity for cooking and water heating discredited by the utterances of members of the board of commissioners over the air, in press and before public meetings, the gas industry has never before had such a break.

A canvass of important electrical dealers and department stores of Los Angeles shows them clearing their stocks of electric ranges and not reordering.

### *Break Political Power*

Basis for the reorganization of the entire Department of Water and Power was an engineering report by Ford, Bacon & Davis, Inc., ordered by the Board of Water and Power Commissioners. This board, of which the controlling three members were appointed by Mayor Fletcher Bowron, has repeatedly made public statements that it was endeavoring to break up the political

**ADEQUATE WIRING IN CHATTANOOGA AREA—The setting of the 40,000th meter at the new home of W. W. Dupree at Brainerd, Tenn., gave added impetus to the local certified wiring program. Left to right—S. R. Finley, general superintendent Electric Power Board of Chattanooga; A. T. Roberts, publicity director; N. J. Simmons, secretary; F. H. Southerland (on ladder) and L. Denton, meter service men; C. B. Osborne, sales manager; Will Chamlee, attorney for the board; Charles E. Simpson, office engineer; E. E. Doudna, meter superintendent; W. W. Dupree, owner of the home, and Paul M. McMillan, resident customer supervisor**

power of the Bureau of Power and Light.

The report did not survey the operations of the Business Agent's division, for it went on the assumption that some of the activities would be eliminated. This division on August 1 dismissed between 170 and 200 employees in squeezing itself within the new specifications. The engineers' recommendation that all employees over 65 be retired removed the veteran Burdette Moody from the post of business agent. E. V. Kane, one of his assistants, is acting agent until civil service examinations and the board appoints a successor.

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## Laun Granted Parole

Albert C. Laun, former vice-president of Union Electric Co., has been granted a parole from the federal penitentiary at Leavenworth, Kan., by the Federal Parole Board, it was announced in Washington. He was released September 9.

Mr. Laun was sentenced to a year and a day in Leavenworth last April 26 by Federal Judge Charles Davis for perjury after he had entered a no contest plea, equivalent to a plea of guilty, to an indictment returned by the federal grand jury. The indictment charged he gave false testimony before examiners of the Securities and Exchange Commission who were conducting an investigation of the political activities of Union Electric.

# REA Advances Schedule of 92,000 Miles of Line

***Appropriations of $100,000,000 for 1940-41 work set ahead two months in an effort to avoid conflict with national defense — Agency reports breakdown of costs***

The Rural Electrification Administration has advanced its entire schedule of operations for the 92,000 miles of lines to be built with 1940–41 appropriations of $100,000,000 two months in an effort to avoid any conflict with national defense requirements, which would delay its program.

A month-by-month schedule of projects and of materials required has been prepared by C. A. Winder, director of the division of engineering and operations. This schedule was compiled both as a working chart for REA staff and as a guide to suppliers of poles, wire, transformers and hardware.

### *Seek Working Margin*

Purpose of the two-month step-up in the schedule listings, Mr. Winder said, is to give REA a working margin so that if deliveries are delayed by defense orders projects may still be completed on time.

Of the $100,000,000 appropriation, between $55,000,000 and $60,000,000 will go for materials, including 1,841,080 poles, 211,724 miles of wire, 230,135 transformers and $3,682,160 worth of hardware. Twenty per cent of the total appropriation will be spent for labor and another 10 per cent for overhead. Between $8,000,000 and $10,000,000 is set aside for power plants, most of which will be small Diesel-powered generators.

Largest turbo-generator scheduled for installation this year is an 8,000-kw. unit at the Genoa, Wis., REA project, to bring the capacity to 15,000 kw.

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## Voluntary Priority to Subcontractors

The "voluntary" system of priorities on defense orders established last month now has been extended to subcontractors supplying materials for contractors with preference-rated contracts.

With this new step the system is stated to be the same that would be used if legal priorities actually had been invoked. It is emphasized that continuance of the system on a voluntary basis is dependent on "complete" co-operation by industry.

In several respects this voluntary system goes beyond the authority which would be available under existing priority legislation. The recently passed law merely gives Army and Navy contracts priority over private orders where the law is invoked by the President (this has not been done yet), while the new system gives certain private contracts priority over other private orders. So long as this system works effectively, defense officials consider it a better arrangement than actual invoking of the formal authority.

The plan provides that contractors supplying defense orders with a preference rating may apply the same preference classification (A-1, A-2, etc., or, in emergency cases, AA-1, AA-2, etc.) to subcontract with his suppliers, upon countersignature by the government contracting officer. Deferments necessary to meet delivery dates of preference-rated contracts are to be worked out by negotiation between the contractor and his other customers, with the aid of the Army-Navy Priorities Committee or the defense commission if necessary.

**CONVERSION WATER HEATERS—Harold Canfield of Wisconsin Public Service Corporation, water heating representative, describes before approximately 150 salespeople from this organization, at meetings held at Oshkosh, Green Bay and Wausau, the construction details of a conversion electric water heater which the company is featuring during fall and early winter months as a means of capturing a low-income market for electric water heating. The assemblage of units and insulation are intended to convert 30 or 40 gallon range boilers, in good condition, to fully automatic, slow-recovery electric systems**

# Measurement Emphasized at I.E.S. 34th Convention

***Addresses on current political and international situations, joint sessions with Inter-Society Color Council and National Lighting Sales Conference round out Spring Lake proceedings***

Pure engineering, with emphasis upon measurement, characterized the sessions of the 34th annual convention of the Illuminating Engineering Society held last week at Spring Lake, N. J. An innovation this year was a joint session with the Inter-Society Color Council, in which four papers on color vision, color determination, color systems and color discrimination were given. Two addresses on current political and international situations, one by Gov. A. Harry Moore of New Jersey at President Graves' reception, and the other by Miss Vivien Kellems, Kellems Products, Inc., at the ladies' luncheon, brought a new note to the convention.

In his opening address President Lester H. Graves reported on the strength of the organization membership and offered suggestions for further strengthening the operations of the society.

Due to time limitations and the fact that the hotel had its own service, and that direct current of limited supply, the lighting progress report, which was made by C. E. Weitz, General Electric, was not as elaborate as it has been. The report, however, covered rather thoroughly all of the major categories.

The address of welcome was given by T. R. Crumley, president of Jersey Central Power & Light Co., who stated that in a recent survey among a representative group of customers 40 per cent indicated that if they could have extra service at no increase in the bill they would choose lighting.

In the technical sessions a method for predetermining design characteristics for molded shapes by means of paper models was described by G. R. Baumgartner, General Electric. The committee on characteristics of illuminating materials reported on its investigation of methods for testing diffusing materials.

### *Fluorescent Discussed*

Considerable data and practical information on the design and installation of fluorescent lighting were given in a series of paper by W. M. Potter and W. G. Darley, General Electric; W. V. C. Foulks, Curtis Lighting, and O. P. Cleaver, Westinghouse. These papers took up characteristics of light sources, photometric data on continuous-source luminaires and effect of fluorescent lighting on colored objects, particularly food products. A discussion of alternating-current circuits for fluorescent lamps was given by R. F. Hays and D. S. Gustin, Westinghouse Lamp Division. The measurement of illumination from gaseous discharge lamps was discussed by A. E. Parker, Electrical Testing Laboratories.

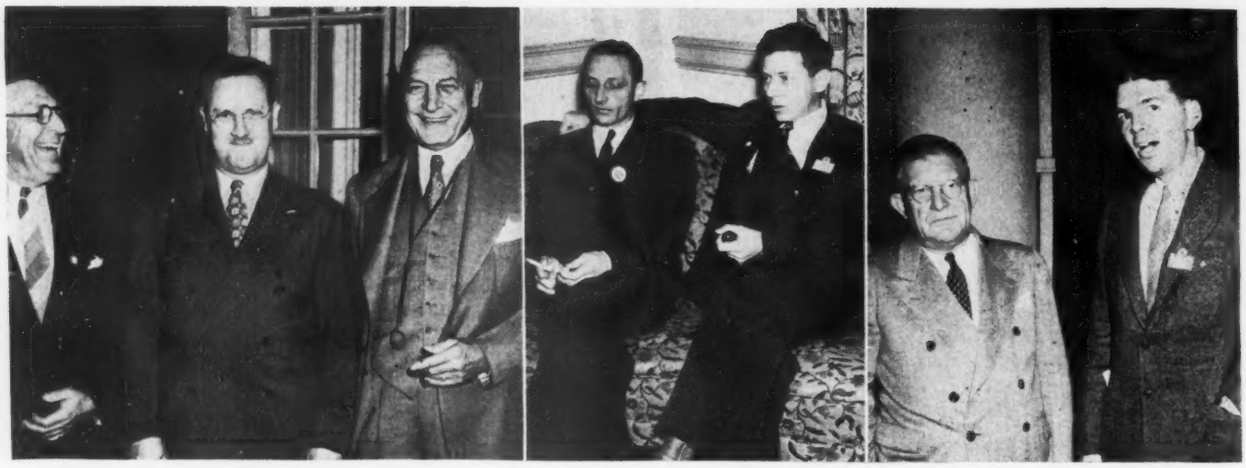
At the Tuesday morning session the physics of lighting was given prominence in papers on relation between electric and spectroscopic characteristics on low-pressure discharges by C. G. Found and E. F. Hennelly, General Electric; radiation from high-pressure mercury arcs by E. B. Noel, General Electric; ultraviolet excitation of fluorescent compounds by J. W. Marden and N. C. Beese, Westinghouse Lamp Division; bactericidal ultraviolet radiation and its uses by H. C. Rentschler, Westinghouse Lamp Division, and prediction of illumination at a point from source of any shape by H. H. Higbie, University of Michigan.

**Retiring President Lester H. Graves and President-elect A. D. Cameron**

### *Application Studies*

The more practical side of lighting was given consideration in papers by Howard Haynes, General Electric, on the use of radiant energy for the application of heat; by R. E. Farnham, General Electric, on the lighting of photochemical reproduction processes; by Henry B. Dates, reporting for his committee on improved school lighting, and by L. H. Brown, Stanford University, on the design of classrooms for high level daylight illumination. Mr. Haynes presented a new graphical method for estimating wattage and number of radiant lamps required for certain industrial processes. The characteristics of material employed in photo-engraving, lithography and similar photo-chemical reproduction processes were outlined by

**B. G. Regar, Philadelphia Electric; A. S. Turner, General Electric; Dean M. Warren, Nela Park; A. F. Dickerson, General Electric; R. A. Manwaring, Pemco; Howard M. Sharp, Buffalo Niagara & Eastern Power; H. G. Clum, Jersey Central Power & Light**



**W. T. Blackwell, Public Service Electric & Gas (N.J.); Bob Hartenstein, Ohio Edison; L. A. S. Wood, Westinghouse; Phil Peeples, Georgia Power; Mason Guillory, New Orleans Public Service; Richard E. Swift, Atlantic City Electric; M. W. Waterman, Central Hudson Gas & Electric Corp., Poughkeepsie, N. Y.**

Mr. Farnham, together with the lighting requirements of these processes.

New illuminants have raised to the forefront a question of heat from light sources. Howard M. Sharp, Buffalo Niagara & Eastern Power, outlined test procedures for determining these values and gave data on comfort reactions of occupants. It is expected that this work will find a widening study, including groups from air-conditioning and paint industries.

Methods for determining the proper lighting of sculpture were described by H. L. Logan, Holophane. Some practical data on fluorescent lighting for private homes of varying family incomes were given by Miss Myrtle Fahsbender and R. G. Slauer, Westinghouse Lamp Division. The report of the committee on residence lighting, showing progress in rating residence luminaires, was made by W. F. Little, Electrical Testing Laboratories.

### *Lighting Conference*

The final day of the meeting was given over to the annual National Sales Lighting Conference, under the chairmanship of R. F. Hartenstein, at which D. J. Frandsen described operations for evaluating the lighting kilowatt used by the Public Service Company of Oklahoma. S. B. Williams, editor of ELECTRICAL WORLD, gave an analysis of the economic characteristics of the commercial lighting load. A series of photographs representative of current fluorescent lighting practice from all parts of the country were shown with comments by M. N. Waterman, Central Hudson Gas & Electric. Fred J. Brown gave a very complete description of the operations of the Central New York Power lighting service department.

A symposium on residence lighting sales, led by Mrs. Mariquita Dygert, Detroit Edison, brought forth the operations of the Georgia Power Company and the Philadelphia Electric Company activities by Miss Fern Snider of the former and Mrs. Katharine T. Goodall of the latter. G. K. Hardacre described the new ideas of the Public Service Company of Northern Illinois and J. E. North, Cleveland Electric Illuminating, spoke on planning. The important thing in this session was a discussion of the proper E.A.R. value to be placed against added residential lighting load.

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## Investigation Under Way in Wisconsin

Wisconsin Electric Power Co. and Milwaukee Electric Railway & Transport Co. officials were believed to be among those subpoenaed to appear before a federal grand jury investigation which opened in Milwaukee September 9.

Also believed summoned as witnesses in the investigation of "alleged violations of the public utility holding company act, the federal power act, the mail fraud statute and other criminal laws of the United States" were Milwaukee aldermen and state legislators.

Federal Judge R. Ryan Duffy published an order prohibiting publication of the names of witnesses or of the witnesses' "purported testimony or conduct before the grand jury" and instructed court attaches and jurors not to publish or comment upon the proceedings.

Among the investigators and attorneys reported to be in attendance at the investigation were men who participated in the recent investigation at St. Louis and Springfield, Mo., into the affairs of the Union Electric Co. of Missouri, which is a subsidiary of the North American Co. The Milwaukee companies are subsidiaries of North American.

## Consumers Power to Have Run-off Poll

The National Labor Relations Board announced that a run-off election would be held among employees of Consumers Power Company, Jackson, Mich., to determine whether they desire to be represented by International Brotherhood of Electrical Workers (AFL), or by Utility Workers Organizing Committee (CIO). It is planned to hold the polls on September 24, 25 and 26.

Board action follows an "inconclusive" poll held August 13-16, 1940, which resulted in a count of 1,020 votes for the AFL union, 1,302 for the CIO union and 368 votes for neither organization. The run-off election will be held among the same employees who participated in the August election.

On September 10 both unions petitioned the board to direct the holding of a run-off election, and both parties likewise requested that the choice be between the A. F. of L. and C. I. O. union. "In view of this request," the decision stated, "we shall direct the holding of a run-off election in the form agreed upon by the two labor organizations involved."

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## City Council Authorizes Plant Expansion Plan

City Council of Richmond, Ind., has authorized expenditures of $554,000 to begin an expansion program for the municipal electric plant.

Additional improvements to the light plant have been tentatively planned for 1941. They will include a new boiler unit to cost $225,000, additional building alteration and construction, $40,000, and a new dam in Whitewater River, $35,500.

# Street, Highway Lighting Offer New Opportunity

***Rocky Mountain Electrical League holds annual meeting at Albuquerque with more than 300 in attendance — Lighting and adequate wiring chief topics — Buck is new president***

Street and highway lighting presents the big opportunity for the future, comparable to the I.E.S. activity and the kitchen modernization program, Gaylord B. Buck, Public Service Company of Colorado, told some three hundred electric utility men, electrical contractors and manufacturers' representatives at the annual convention of the Rocky Mountain Electrical League in Albuquerque, N. M., last week.

Speaking at the second general session of the annual meeting, Mr. Buck summed up the thought embodied in the dramatized presentation on street and highway lighting by Chairman Murray Graff, General Electric Co., which included a demonstration of the theory and application of the new street lighting evaluator (ELECTRICAL WORLD, July 27) by Kirk M. Reid of the General Electric research laboratories at Nela Park. One of these units has been purchased by the R.M.E.L. and is available to its members.

### *R.M.E.L. Program*

As another feature of this presentation, Dana Rowten, Public Service Company of Colorado, outlined the program of the R.M.E.L. with respect to improving street and highway lighting in the three states in which the league operates, Colorado, Wyoming and New Mexico. He told also of recent improvements in street and highway lighting in Denver, employing fixtures using one 400-watt mercury-vapor lamp and two 100-watt Mazda lamps on streets and sodium-vapor lamps on viaducts, which has been effective in reducing fatalities at night. A relighting program has been drafted for the entire city, he added, which would require some five to ten years for completion.

The principle of fluorescent lamps was explained and demonstrated by C. F. Jensen, Westinghouse, St. Louis, who also urged that the fluorescent lamps be thought of as a new tool or device, rather than as a new lamp. W. B. McKechnie, also of Westinghouse, recommended that fluorescent lighting installations be sold on the basis of providing "Better Light—Better Sight." A. J. Walter, of General Electric's incandescent lamp department, stressed the need for increased attention to designing fixtures for the new tubular light sources.

H. T. Rankin, Public Service Company of Colorado, chairman of the league's lighting division, reported the successful conduct of two fluorescent lighting schools by the league during the past year and warned of the current "muscling in" on fluorescent fixture manufacture and installation by tinsmiths, plumbers and others. He recommended selling the fixtures by talking to the customer in his own terms, avoiding technical phrases and using instead the approach of giving the customer more light for the money he spends.

At a dramatized presentation on adequate wiring delegates showed a lively interest in a portable kit developed by Ralph E. Johnson, Sturgeon Electric Co., Denver, which illustrated the effect of operating various appliances at normal and at 10 per cent below rated voltages.

Recent central station apparatus developments were described by A. C. Monteith, engineering manager of Westinghouse's central station section. He said that more than 90 per cent of the generating units installed in the past five years had been hydrogen-cooled units.

At the annual banquet, on Monday night, Ralph E. Johnson, chairman of the league's adequate wiring division, received a citation for his contribution to this activity. Don C. Germond, Mountain States Power Co., Casper, Wyo., received the league's award for outstanding accomplishment during 1940, for the effective dealer-co-operative program in his company's territory.

New officers of the league for 1941 are: Gaylord B. Buck, president; Arthur Prager, Albuquerque Gas & Electric Co.; W. D. Johnston, Mountain States Power Co., Casper, Wyo.; Luke Storey, Home Gas & Electric Co., Greeley, Colo., Ross E. Adams, Hendrie & Bolthoff Co., Denver, vice-presidents. W. C. Sterne, Arvada Electric Co., Arvada, Colo., and George E. Lewis, Denver, were re-elected treasurer and secretary, respectively. In accepting office President Buck said: "Unity is the watchword for 1941!"

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## Bonneville to Open Bids on 30-Mile Power Line

Bonneville Power Administration will open bids on October 10 for the construction of a 30-mile power transmission line between Yakima and Ellensburg, Wash. The bids will be opened in Portland, Ore.

The line will be of wood-pole construction capable of carrying Columbia River power at 115,000 volts. It will be the first of two units which will feed Columbia River power to central Washington. A second unit, connecting Yakima with the Bonneville-Grand Coulee line at Vernita, is now being designed.

**R.M.E.L. CONVENTION—Seen at the sessions of the Rocky Mountain Electrical League held in Albuquerque (left to right): George E. Lewis, Denver, league secretary; H. E. Samson, Southwestern Public Service, Roswell, N. M., 1940 league president; Arthur Prager, Albuquerque Gas & Electric, convention chairman; Don C. Germond, division sales manager Mountain States Power Co., Casper, Wyo., who won the R.M.E.L. award for outstanding accomplishment in 1940; Gaylord B. Buck, general sales manager Public Service Co. of Colorado, Denver, who was elected president of the league, and T. M. Foulk, Public Service Co. of Colorado, and Ralph Johnson, Sturgeon Electric Co., Denver, who run the R.M.E.L. Adequate Wiring Bureau**

## St. Lawrence Power Now Defense Step

President Roosevelt has again revived the St. Lawrence waterway power development scheme and Washington expects a dramatic attempt to win Senate approval of a Canadian-U.S. treaty dressed up in national defense clothing before the election.

The new St. Lawrence deal is temporarily stripped of all navigation aspects and would be a straight power development agreement, the argument being that both countries will need additional generating capacity in two or three years and that it would take that long to build them. The door would be left open for navigation development later, however.

Negotiations for a treaty which can be shoved before the Senate are technically in the hands of the joint Canadian-U.S. defense board. Actually, the talks are being directed by the President, who has assigned Assistant Secretary of State Berle and Federal Power Chairman Olds to work on the deal. Any proposal, of course, will have the stamp of approval of the defense board.

There is the possibility that the President might attempt to put over the St. Lawrence scheme as some sort of "trade" to by-pass Senate action, similar to the destroyer-bases deal with Britain. It is considered likely, also, that whatever plan is brought forward will call for the U.S. to put up practically all the necessary money.

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## High-Pressure Unit for Sherman Creek

Latest extension in the construction program of the Consolidated Edison Company of New York, Inc., is the topping of the Sherman Creek station, located at 201st Street and the Harlem River. This 200-lb. station, placed in operation in 1913 and increased in capacity from time to time, contains six turbine-generators aggregating approximately 140,000 kw.

This topping installation will consist of a 1,000,000-lb.-per-hour steam-generating unit, designed for 1,775-lb. pressure and supplying steam at 1,600 lb., 955 F. to a Westinghouse 50,000-kw., 3,600-r.p.m. turbine-generator exhausting to the present 200-lb. station header.

The steam-generating unit, for which contract has been let to Combustion Engineering Co., will be of the three-drum, bent-tube type with Elesco superheater and economizer, two Ljungstrom regenerative air preheaters and a steam washer in the steam drum. It will be tangentially fired with pulverized coal from three C-E Raymond bowl mills and have a continuous slag-drip furnace bottom. In addition to the twelve coal burners, three in each corner, there will be two oil burners in each corner, between the coal burners, and four horizontal oil burners, located in the front upper wall. The latter are for maintaining performance with oil comparable to that when burning coal.

Plain bifurcated tubes will be employed for the front, rear and side furnace walls and the roof and bottom will have fin tubes. The unit itself will occupy a space 49x53 ft. between building columns and will extend approximately 90 ft. to the top of the air heaters, the mills being located at the basement level.

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## Integration Ideas Expected from SEC

Reports from Washington are reviving the story that SEC will issue its own integration plans for utility systems and that the first report to be issued in the near future will reveal SEC views as to how United Gas Improvement must integrate to conform with the death sentence.

Under Section 11(b)1 of the Holding Company Act the utility organization "shall take such action as the commission shall find necessary" and an outline of SEC tentative integration plans has already been requested by Bond & Share, Standard Power & Light, Standard Gas & Electric, Middle West, Cities Service and North American.

Versions have appeared in SEC offices of plans for Cities Service and North American, but no complete formal expression of SEC views on these two situations has appeared.

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## Municipal Utilities Meet on National Power Defense

Representatives of municipal electric generating systems met with the National Power Policy Committee in Washington last week to discuss questions of plant sabotage and adequacy of operating facilities to meet defense loads.

The meeting was a sequel to similar meetings with private utility representatives. About 40 municipal systems, including most of those in larger cities, were represented at the meeting. The utility operators agreed to work in close harmony with the Federal Power Commission to anticipate defense problems, but nothing specific developed from the session.

# MEETINGS

**International Association of Electrical Inspectors**—Annual meeting, western section, Kansas City, Mo., September 23-27; eastern section, New York, N. Y., October 7-11.

**Association of Iron and Steel Engineers**—National convention, Chicago, Ill., September 24-27 Brent Wiley, managing director, Empire Bldg., Pittsburgh, Pa.

**Indiana Electric Association**—Annual convention, French Lick, Ind., September 25-27, R. E. Blossom, secretary, 1414 Circle Tower, Indianapolis, Ind.

**Empire State Gas and Electric Association**—Annual convention, Westchester Country Club, Rye, N. Y., September 26-27, George H. Smith, secretary, Grand Central Terminal, New York, N. Y.

**Electrochemical Society**—Fall meeting, Chateau Laurier, Ottawa, Canada, October 2-5. Colin G. Fink, secretary, Columbia University, New York, N. Y.

**Public Utilities Association of West Virginia**—Meeting of utilities of Virginia and West Virginia, Greenbrier Hotel, White Sulphur Springs, W. Va., October 4-5. A. Bliss McCrum, secretary, 612 Charleston National Bank Bldg., Charleston, W. Va.

**National Safety Council**—Annual congress and exposition, Stevens Hotel, Chicago, Ill., October 7-11; public utilities section, Tuesday Afternoon, October 8 and Thursday Afternoon, October 10. W. H. Cameron, managing director, 20 North Wacker Drive, Chicago, Ill.

**Edison Electric Institute**—Electrical equipment committee, Jefferson Hotel, Richmond, Va., October 7-8; transmission and distribution committee, Henry Grady Hotel, Atlanta, Ga., October 14-16. H. S. Bennion, managing director, 420 Lexington Av., New York, N. Y.

**American Institute of Electrical Engineers**—Middle Eastern district meeting, Cincinnati, Ohio, October 9-11; winter convention, Philadelphia, Pa., January 27-31. H. H. Henline, national secretary, 33 West 39th St., New York, N. Y.

**National Commercial Electric Cooking Council**—Fourth annual conference, Hotel Knickerbocker, Chicago, Ill., October 10.

**International Municipal Signal Association**—Annual meeting, Roosevelt Hotel, Jacksonville, Fla., October 14-17. Irvin Shulsinger, secretary, Eight East 41st St., New York, N. Y.

**Porcelain Enamel Institute**—Annual forum, University of Illinois, Urbana, Ill., October 16-18.

**American Welding Society**—Annual meeting in conjunction with the National Metal Exposition, Cleveland, Ohio, October 20-25. Miss M. Kelly, secretary, 29 West 39th St., New York.

**National Electrical Contractors Association**—Fall meeting George Washington Hotel, Jacksonville, Fla., October 21-23. L. W. Davis, general manager, 420 Lexington Avenue, New York, N. Y.

**National Electrical Wholesalers Association**—Semi-Annual convention, Hotel William Penn, Pittsburgh, Pa., October 22-25. E. Donald Tolles, managing director, 165 Broadway, New York, N. Y.

**National Electrical Manufacturers Association**—Annual meeting, Waldorf-Astoria Hotel, New York, N. Y., October 27-November 1. W. J. Donald, managing director, 155 East 44th St., New York, N. Y.

**National Research Council**—Conference on Electrical Insulation, annual meeting, Washington, D. C., October 31-November 2. Thorstein Larsen, secretary, Consolidated Edison Co., 55 Johnson St., Brooklyn, N. Y.

**Wisconsin Utilities Association**—Annual convention, electric section, commercial and technical divisions, Hotel Pfister, Milwaukee, November 11-12. A. F. Herwig, executive secretary, 135 West Wells St., Milwaukee, Wis.

**Adequate Wiring Conference**—Sponsored by the National Adequate Wiring Bureau and the International Association of Electrical Leagues, Palmer House, Chicago, November 12.

**International Association of Electrical Leagues**—Annual conference, Palmer House, Chicago, November 13-14. O. C. Small, secretary, 155 East 44th St., New York, N. Y.

**Illinois Public Utilities Association**—General meeting, Hotel Pere Marquette, Peoria, Ill., November 14-15. Jack Abbey, secretary, 935 Illinois Bldg., Springfield, Ill.

**American Society of Mechanical Engineers**—Annual meeting, New York, N. Y., December 2-5. C. E. Davies, national secretary, 29 West 39th St., New York, N. Y.

**American Society of Agricultural Engineers**—Fall meeting, Chicago, Ill., December 2-6.

## Output Near All-Time Peak, 7.9% Over 1939

Surpassing the figure for the corresponding period a year ago by 7.9 per cent, the output of energy by the electric light and power industry during the week ended September 14 rose 7.1 per cent compared with the preceding week to 2,638,634,000 kw.-hr., according to the Edison Electric Institute. This was less than 0.1 per cent short of the all-time peak recorded last December. It indicates a gain of 19.1 per cent over the week of September 17, 1938, and of 15.9 per cent compared with the week of September 18, 1937.

While operations continue to be well above those a year ago the margin has narrowed somewhat in the past two weeks; during most of July and August it ranged between 10 and 12 per cent.

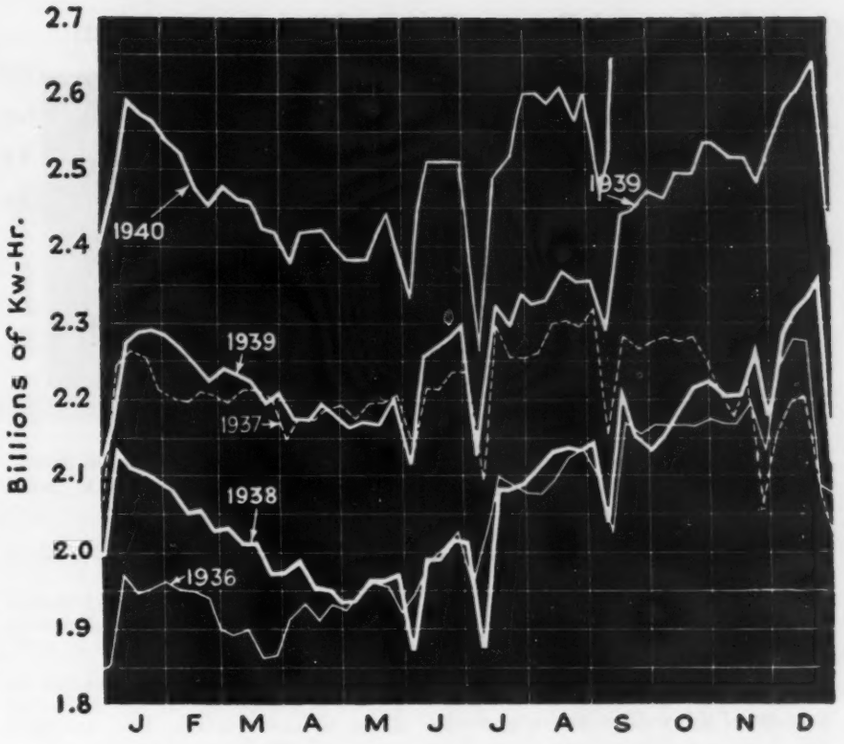
Regionally the lead as to the increase over 1939 has passed to the Central Industrial area, up 11.8 per cent, while in the Rocky Mountain section gains at times exceeding 20 per cent in July and August have decreased sharply. In the industrial East, in contrast, gains recently have tended to widen.

**Weekly Output, Millions Kw.Hr.**

| 1940 | | 1939 | | 1937 | |
|---|---|---|---|---|---|
| Sept. 14 | 2,639 | Sept. 16 | 2,444 | Sept. 18 | 2,281 |
| Sept. 7 | 2,463 | Sept. 9 | 2,290 | Sept. 11 | 2,154 |
| Aug. 31 | 2,601 | Sept. 2 | 2,357 | Sept. 4 | 2,321 |
| Aug. 24 | 2,571 | Aug. 26 | 2,355 | Aug. 28 | 2,295 |
| Aug. 17 | 2,606 | Aug. 19 | 2,368 | Aug. 21 | 2,304 |
| Aug. 10 | 2,589 | Aug. 12 | 2,333 | Aug. 14 | 2,301 |
| Aug. 3 | 2,605 | Aug. 5 | 2,325 | Aug. 7 | 2,262 |

**Per Cent Change from Previous Year**

| | Week Ending | | |
|---|---|---|---|
| | Sept. 14 | Sept. 7 | Aug. 31 |
| New England | + 6.1 | + 4.5 | + 4.5 |
| Middle Atlantic | + 7.9 | + 5.4 | + 6.8 |
| Central Industrial | +11.8 | +12.4 | +15.7 |
| West Central | + 2.7 | + 4.6 | + 8.6 |
| Southern States | + 2.9 | + 6.2 | +10.0 |
| Rocky Mountain | + 9.4 | +12.0 | +10.7 |
| Pacific | + 6.1 | + 3.9 | + 4.1 |
| United States | + 7.9 | + 7.5 | +10.3 |




## Plattsburg Utility Bought Out by City

Terminating four years of litigation, the city of Plattsburg has reached a tentative agreement with the New York State Electric & Gas Co. for purchase of the latter's distribution facilities for approximately $200,000.

The agreement, it is said, is contingent upon approval by the Federal Power Commission, the Securities and Exchange Commission, the Public Works Administration and the Second District, New York Federal Court, supervisor of the company, which is a subsidiary of the Associated Gas & Electric Corp.

A municipal generating plant is nearing completion and will be ready for use when the distributing facilities have been acquired. Forty-five per cent of the cost of purchasing the distributing facility will be financed through PWA and will serve approximately 5,000 customers.

The company had sought for four years to prevent the city from constructing its own generating plant. In 1939, however, a decision of the state Court of Appeals granted the city this right, and final settlement came last March when the court declined to reopen the case for further argument.

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## Hydro Capacity Rises to 18,500,254 Hp.

Water-power plants of 100 hp. or more in the United States had a total installed capacity on January 1, 1940, of 18,500,254 hp., compared with 17,948,906 hp. at the beginning of 1939, according to a report by the Federal Power Commission. This indicates an increase during the year of 551,348 hp., or 3.1 per cent. About half of the increase was in new plants, the remainder in additions to existing installations. Including outlying territories the total was 18,649,652 hp.

Of the total in the 2,872 plants in the United States, 16,400,752 hp. in 1,544 plants was in publicly and privately owned electric utilities; the remaining 2,099,502 hp. was in 1,328 industrial and miscellaneous plants.

The five states showing the largest increase in horsepower during the year were: Arizona, 232,830; Virginia, 109,087; Alabama, 101,032; Tennessee, 69,158; Wyoming, 45,039 hp.

The ten states having the largest installed waterpower capacity as of January 1, 1940, are:

| State | Electric Utilities | Installed Water Power (1,000 hp.) Industrial Companies | Total | Per Cent of U. S. |
|---|---|---|---|---|
| California | 2,416 | 17 | 2,433 | 13.16 |
| New York | 1,648 | 202 | 1,850 | 10.00 |
| Washington | 1,143 | 70 | 1,213 | 6.56 |
| Alabama | 1,133 | 12 | 1,145 | 6.19 |
| No. Carolina | 577 | 378 | 954 | 5.16 |
| So. Carolina | 792 | 46 | 838 | 4.54 |
| Nevada | 709 | 0 | 709 | 3.83 |
| Maine | 311 | 301 | 612 | 3.31 |
| Georgia | 568 | 27 | 595 | 3.22 |
| Tennessee | 419 | 169 | 588 | 3.18 |

As appears from the following table, 88.4 per cent of the total capacity is concentrated in the group of plants having a capacity of 5,000 horsepower or larger.

| Group (Hp.) | No. of Plants | Horsepower | % of Total Hp. |
|---|---|---|---|
| 5,000 or more | 499 | 16,357,123 | 88.4 |
| 1,000 to 5,000 | 693 | 1,576,542 | 8.5 |
| 100 to 1,000 | 1,680 | 566,589 | 3.1 |
| Total | 2,872 | 18,500,254 | 100.0 |

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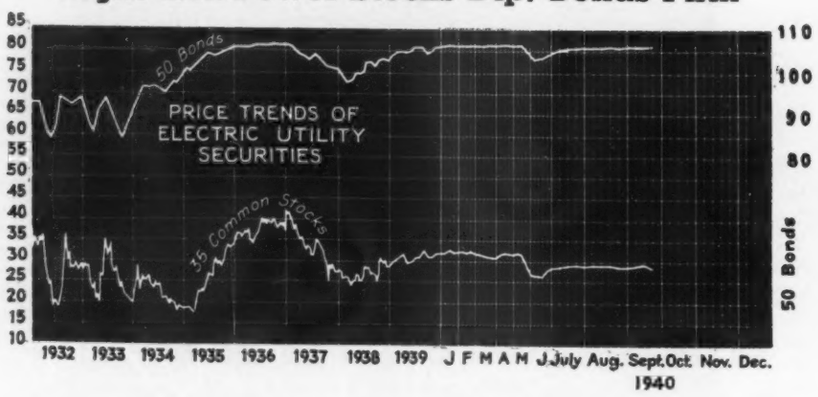
## Resume Common Dividend

New Orleans Public Service, Inc., voted a dividend of 10 cents a share on the common stock, the first since January 3, 1933, when 14 1/6 cents was distributed.

## Light and Power Stocks Dip; Bonds Firm


50 Bonds
PRICE TRENDS OF ELECTRIC UTILITY SECURITIES
35 Common Stocks
85 80 75 70 65 60 55 50 45 40 35 30 25 20 15 10
110 100 90 80
50 Bonds
1932 1933 1934 1935 1936 1937 1938 1939 J F M A M J July Aug. Sept. Oct. Nov. Dec. 1940

**A mixture of gains and losses in the utility stock list brought the "Electrical World" index down to 28.8 this week, compared with 29.1 last week; last year, 30.5. Bonds held firm at 105.9, unchanged from preceding week.**

## Stock Retirement Planned by Utility

With a view to retiring additional amounts of its own first preferred stock, the American Superpower Corp. has notified holders of these shares of its willingness to exchange them for the preferred stocks of certain public utility companies held in its portfolio.

The shares made available for exchange are 1,000 shares of $7 preferred stock of the Applachian Electric Power Co., 3,000 shares of $6 preferred stock of the Louisiana Power & Light Co., 900 shares of New York Power & Light Corp. 7 per cent preferred stock and 1,000 shares of Ohio Edison Co. $6 preferred stock.

Only such amounts of American Superpower first preferred stock will be accepted under the options as will permit the issuance of full shares of the stocks offered in exchange.

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## Utilities Register New Bond Issues

Central Maine Power Co. has filed a declaration under the Holding Company Act regarding the issuance and sale of a maximum of $18,100,000 of 3½ per cent first and general mortgage bonds, Series L, due 1970, and 20,000 shares of $50 preferred stock, $50 par value, 5 per cent dividend series.

Proceeds from the sale of the securities will be used to refund $16,600,000 of 4 per cent first and general mortgage bonds, Series G, due in 1960; to retire bank indebtedness and provide funds for the purchase and construction of property.

Connecticut Power Co. has filed with the SEC a registration statement covering $4,000,000 of Series C first and general mortgage 3¼ per cent bonds due November 1, 1975. Bonds are to be offered to stockholders.

Gulf Public Service has completed the sale of $1,320,000 first 3¼ per cent serial bonds to the Equitable Life Assurance Society of the United States.

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## Simplification Hearings Open for Bond & Share

Simplification of the corporate structure of Electric Bond & Share Co. cannot take definite form until geographical integration has materialized, death sentence proceedings of the SEC are aggravating the difficulties of securing new capital required under the defense program and 42 operating companies may be regrouped into four integrated systems, S. R. Inch, president of Electric Bond & Share, testified before the SEC last week.

SEC has recently initiated hearings as part of a proceeding to compel the company to simplify its corporate setup in conformance with Section 11(b)2 of the 1935 law.

Particular attention is being given by SEC to the continued existence of three subholding companies, American Power & Light, Electric Power & Light and National Power & Light, which S. W. Murphy, vice-president, states now have $400,000,000 of funded debt.

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## Counsel for Associated Withdraws Claims Plea

Federal Judge John P. Barnes has permitted counsel for the Associated Investing Corp. and the Associated Utilities Corp. to withdraw a petition for fees and expenses amounting to more than $500,000.

These corporations are subsidiaries of the Associated Gas & Electric Corp. of New York. The fees and expenses which had been requested were the outgrowth of the reorganization of the Utilities Power & Light Corp. under federal court supervision.

Associated Investing and Associated Utilities were parties to the reorganization, having held blocks of stock in the Utilities Power & Light Corp.

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## Hearings Ordered for Wyman Companies

Securities and Exchange Commission this week took a step into another utility situation when it ordered hearings under Section 11(b)2 to start October 14 with respect to New England Public Service Company and Northern New England Company, known in the industry as the Wyman group. This is the fourth group to be cited under the new simplification series, others being Electric Bond & Share, Standard Power & Light and International Hydro-Electric.

Northern New England Company, generally regarded to be a common law trust and alleged to be parent of New England Public Service, was described by SEC as fulfilling no useful public function, contributing to inequitable distribution of voting power and existing in violation of Section 11(b)2.

New England Public Service Co. is in itself a registered holding company, principal subsidiaries consisting of Central Maine Power, Central Vermont Public Service, Cumberland County Power & Light, Public Service of New Hampshire and Twin State Gas & Electric.

The SEC order asserted that common stock of New England Public Service comprised 11.64 per cent of total capitalization, but exercised 74.33 per cent of the voting power. Also, said the SEC order, the corporate structure is unduly complicated due to the existence of three classes of preferred stock.

## Utility Reports

| | Net Income 1940 | 1939 |
|---|---|---|
| *Carolina Power & Light.. | $2,988,368 | $2,387,594 |
| *Dallas Power & Light..... | 1,756,491 | 1,604,097 |
| *El Paso Electric..... | 434,623 | 361,538 |
| *Gulf States Utilities..... | 2,746,684 | 2,266,948 |
| *Kansas City Power & Light | 3,905,111 | 3,765,234 |
| *Kansas Gas & Electric..... | 1,317,081 | 1,181,169 |
| *National Power & Light and subs. ..... | 9,152,370 | 7,229,579 |
| *Pacific Power & Light..... | 871,532 | 960,644 |
| *Pennsylvania Power & Light | 9,570,500 | 7,595,771 |
| *Puget Sound Power & Light and subs. ..... | 2,067,571 | 1,988,995 |
| *Savannah Electric & Power | 322,951 | 411,812 |
| *Virginia Electric & Power. | 4,076,253 | 3,773,274 |
| *Washington Water Power and subs. ..... | 3,148,726 | 2,853,873 |
| *Western Public Service and subs. ..... | 165,662 | 174,292 |

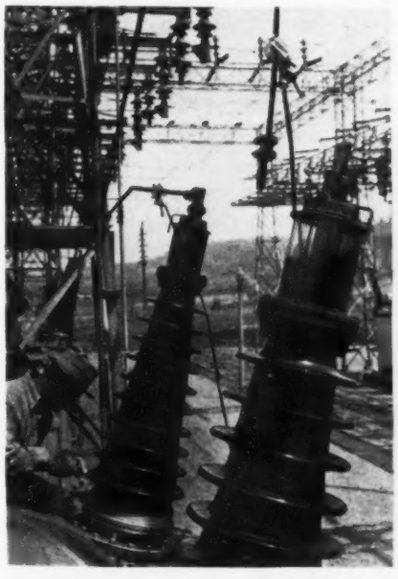
*Twelve months ended July 31.

# OPERATING PRACTICES

## Flat-Jaw Clamps for Grounding

By E. A. MACK
Appalachian Electric Power Company, Huntington, W. Va.

Properly to safeguard inspection, maintenance and emergency repair work on station apparatus, it is often necessary to employ some form of portable grounding equipment. If this equipment includes conventional



**GROUNDING operations facilitated by universal clamps with parallel jaws**

hook-type clamps grounding operations may often prove very awkward and consume an undue amount of time, especially when situations require attachment to apparatus leads which have been installed in positions at or near the vertical. This is obvious when consideration is given to the fact that the operating stick tends to assume a horizontal position and that the required points of attachment to leads connecting, for example, oil circuit breakers, transformers, etc., may be an appreciable distance above ground level. Restricted working space and lack of clearance to adjacent energized equipment may add to the difficulties.

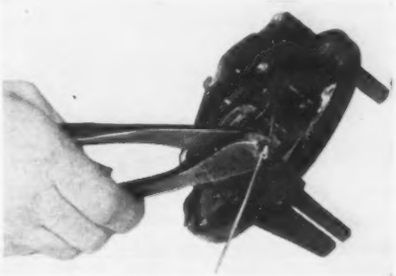
To speed up and make easier grounding operations a simple parallel jaw clamp was developed locally some time ago and has proved entirely satisfactory. This clamp can be attached to conductors, tubing or strap installed at any angle and with the operating stick held in a more or less vertical position. A unit grounding set consists of three conductor clamps and one tower or station ground clamp assembled with flexible copper cables. Conductor clamps are installed by means of a single locking head operating stick. At least two unit sets and one operating stick are kept at all substations, or at other points on the system where frequent safety grounding is necessary. The time required to install grounds, do the job and remove grounds is often an important consideration, especially under emergency conditions.

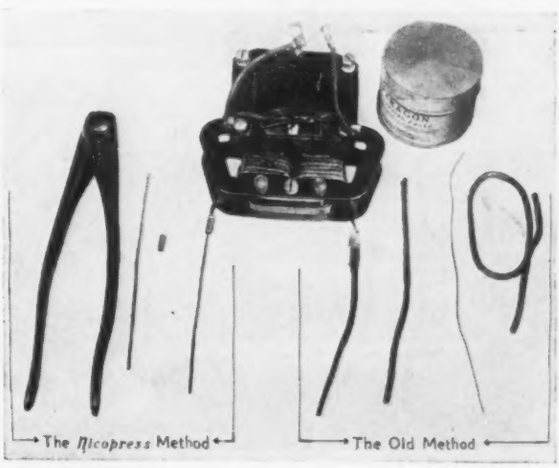
With these clamps installation and removal of grounds to all six leads of a 33-kv. oil circuit breaker have been accomplished in approximately two minutes for each of the two operations.

## Wire Splice Method for Meter Rebuilding

A new method of splicing additional lengths of wires on the leads of a meter current coil in connection with the rebuilding of indoor meters into outdoor cases can effect savings of approximately $500 on rebuilding 11,000 meters, based on a comparison time study made by one power company.

The common method of splicing wire on the leads of the current coil to make them long enough to be con-






**"NICOPRESS" METHOD announced for splicing additional lengths of wires on leads of meter current coil when rebuilding indoor meters into outdoor cases**

nected to the binding posts of a "CS" case consists in "mousing" and soldering a piece of No. 6 stranded wire about 4 in. long to the current coil. The average time for completing a splice in this way is about 2½ minutes, or five minutes for a two-wire meter.

In making the splice by the new method small compression sleeves and approximately 3 in. of wire are used. Two sizes of sleeves are used—a small size for splicing solid to solid wire and a larger size that will splice solid to No. 6 stranded. Tests have shown that each splice can be completed, using a "Nicopress No. 17" tool, in about ¼ minute, or ½ minute for a two-wire meter—a saving of 4½ minutes per two-wire meter.

The new method is a development of the National Telephone Supply Company, Cleveland, Ohio.

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## Emergency Splice for Aerial Cable

By C. H. Le VEE
Assistant to Electric Distribution Manager
Central Hudson Gas & Electric Corporation,
Poughkeepsie, N. Y.

To cut down on the time required to repair trouble on our 13.8-kv. paper and lead aerial cable secondary transmission lines we have developed an emergency splice which may be installed in from 1½ to 2 hours, comparable to the time needed to repair breaks in an open-wire line.

The emergency splice consists of a galvanized thin-wall pipe 3½ in. in diameter, with special gaskets in the end to eliminate the time taken for wiping, and connected by means of flexible metal tubing to a 5-gal. oil reservoir. Tightening the hexagonal nut on the end of the splice compresses a conical oil-resistant rubber washer around the sheath of the lead cable to oil tightness. A permanent wipe may be made later after service has been restored.

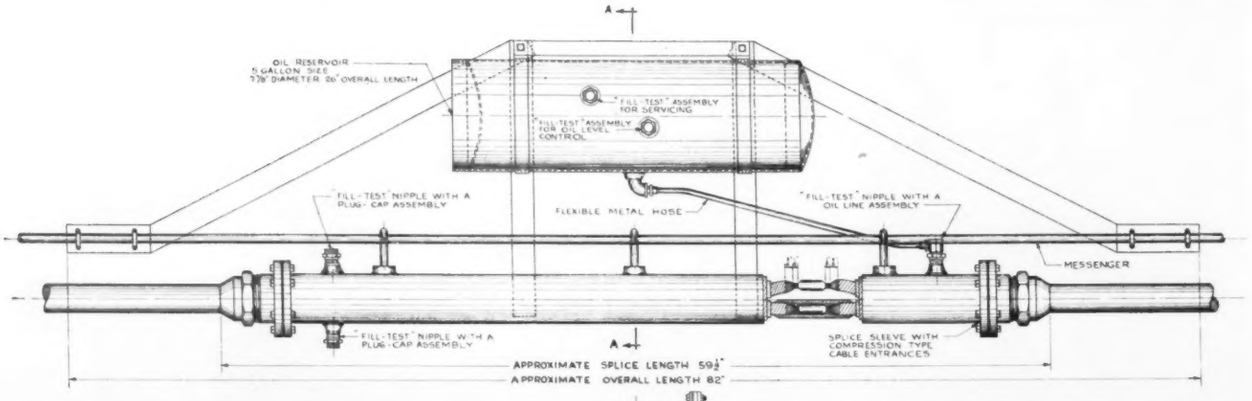
To isolate and insulate the three conductors of the cable a barrier unit —U-shaped laminated tubes fitting within a laminated cylinder—is used, over which the pipe sleeve is placed. By using this type of insulation it is necessary to build up the insulation thickness with tape only over the connections of the conductors. Incidentally, these connections are made with compression-type connectors rather than with the usual split sleeve and solder.

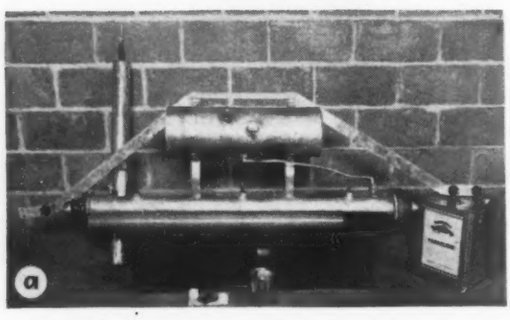
Dimensions of the emergency splice are such that an entire splice in service may be cut out if it fails. The emergency splice is then installed, following these simple directions:

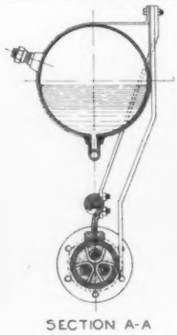
1. Cut 28 in. out of the defective cable at point of failure and slip on emergency splice.
2. Remove 10 in. of cable sheath at each end.
3. Remove 9 in. of belt of cable.
4. Pencil down insulation on individual conductors.
5. Install "filler pieces"—paper-insulated cable with connectors at each end carried in sealed oil-filled cans.
6. Tape, to 1 in. outside diameter, 2¼ in. on each side of connector edge.
7. Install barrier unit.
8. Slip on sleeve and tighten end hexagonal nuts.
9. Install reservoir and fill with oil.

In the event of pothead failure, potheads previously made up with about 15 ft. of 13.8-kv., three-conductor, paper and lead cable are available. The defective pothead is cut out, as well as the riser tail of cable. The new pothead and cable is then installed and the free ends of the cable connected with the emergency splice.

Tests have been conducted on the emergency oil-filled splice for a period of four weeks with 27 kv. between conductors and 13.8 kv. between conductor and ground without failure. Subsequent tests have been made


A
OIL RESERVOIR
5 GALLON SIZE
7¾" DIAMETER 26" OVERALL LENGTH
"FILL-TEST" ASSEMBLY FOR SERVICING
"FILL-TEST" ASSEMBLY FOR OIL LEVEL CONTROL
"FILL-TEST" NIPPLE WITH A PLUG-CAP ASSEMBLY
FLEXIBLE METAL HOSE
"FILL-TEST" NIPPLE WITH A OIL LINE ASSEMBLY
MESSENGER
"FILL-TEST" NIPPLE WITH A PLUG-CAP ASSEMBLY
A
SPLICE SLEEVE WITH COMPRESSION TYPE CABLE ENTRANCES
APPROXIMATE SPLICE LENGTH 59½"
APPROXIMATE OVERALL LENGTH 82"



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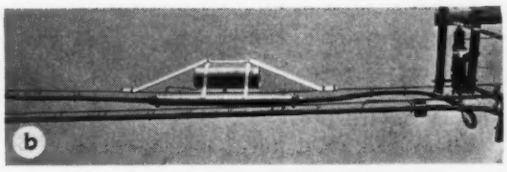



Inserts show emergency splice assembly (a) and installation (b). Barrier unit consists of laminated cylinder, inside of which are three U-shaped laminated tubes, the tubes being placed over the individual conductors and cylinder being placed over all. Then the pipe is placed over the laminated cylinder. In (a) individual tubes extend beyond the end of the cylinder.

**EMERGENCY SPLICE** for 13.8-kv. paper and lead aerial cable may be installed in from 1½ to 2 hours

under the same conditions, but substituting petrolatum for oil, with equally good results. Our present plans, however, call for oil.

While the use of such an emergency splice is limited, we believe it provides excellent insurance for reduced durations of outages on our aerial cable lines, whose operating characteristics and reliability, particularly during such storms as the 1938 hurricane, have warranted its extension until some 80 miles of 13.8-kv. line have been installed.

•

## Automatic Equipment Salvages Used Copper

Salvaging of weatherproof insulated wire for use, with insulation removed, on rural lines or for ground wires where bare copper is permissible, is virtually a completely automatic operation on the property of the Southwestern Light & Power Company, Lawton, Okla. Here employees have built a four-part machine, from scrap and spare parts, which will strip and recoil 50-60 ft. of wire per minute. Design of the device was precipitated by the trend of copper prices in the early months of the European war. The equipment shown consists of pay-off reel, insulation crusher, scraper bar and motor-driven take-up reel.

Pay-off reel is free running, being turned by the tension of the wire as it is drawn into the crusher rolls. Any pay-off reel will do, but the one used at Lawton has a conical iron frame mounted on a discarded display stand.

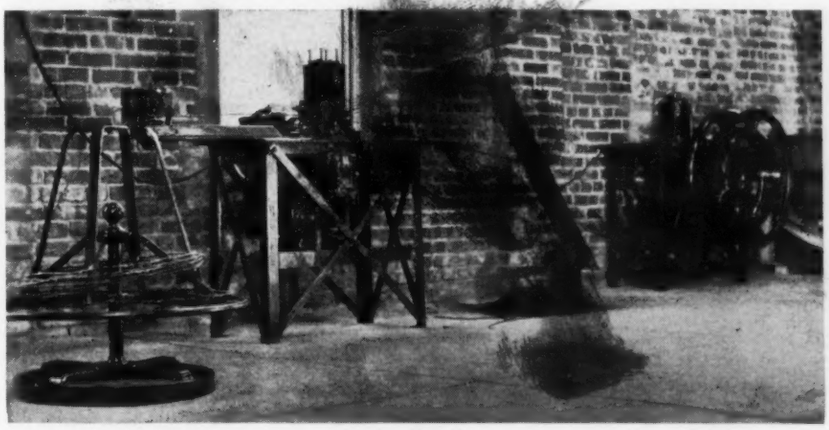
From the reel the wire passes between 3¾-in. diameter cast-iron rolls, having a 4 in. width of face, which are geared together and driven at 60 r.p.m. by a ½-hp., 1,750-r.p.m., single-phase motor belted to a 15/1 worm gear reduction from an old steering mechanism. Spacing between the driving and driven roll is controlled by screw-adjusted springs and can be changed to correspond to wire sizes from No. 10 to No. 2. A limit switch on the roll stand stops the roll motor when a splice is encountered.

The scraper mechanism for removing insulation consists of two 2x2-in. angles held in contact by spring pressure. One of the angles and the spring mount are welded to the scraper base, the other can be moved against the spring to permit the wire to pass between.

Take-up roll consists of a light truck wheel to which pressed steel tractor wheels (spokes cut out) are attached to form flanges, one of which is removable. The reel, 22 in. in diameter, is driven at 9 r.p.m. by a vertical universal motor V-belted to a double reduction mechanism consisting of two automobile steering gear reductions. Slip of the motor takes care of the change in diameter of the coil as it builds up. However, properly to coordinate the reel motor speed with the crusher rolls, the reel motor is operated at reduced voltage from an auto-transformer.

A level winder, which gives about 30-35 strands per layer of No. 6 wire, is used with the reel to insure uniform, compact coiling. It is made up of an idler wheel (over which the wire runs) moved by a heart-shaped cam and follower driven by the reel motor.

Controls for the entire reclaiming equipment are mounted on the crusher stand. Two of the three controls operate the crusher and reel individually during threading. The third switch, which is for regular operation, energizes the crusher drive motor and the take-up reel motor simultaneously. A "hold-in" coil in this switch is in series with the limit switch, previously mentioned, which trips off both motors when a splice in the wire is encountered.



**THIS EQUIPMENT strips and rewinds 50 ft. of wire per minute automatically. Two men assembled the device in three weeks from spare parts**

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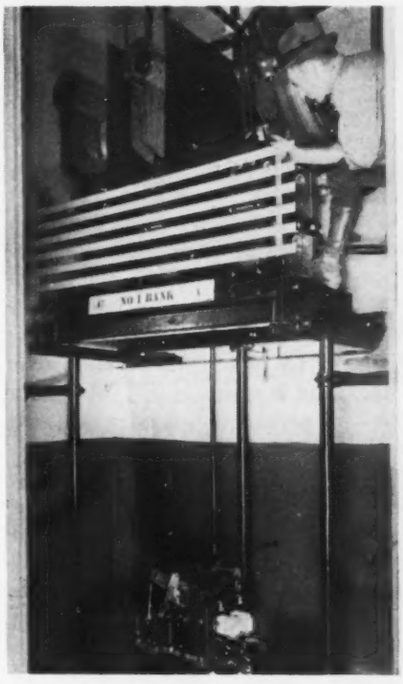
## Air Breakers for 16.5-Kv. Feeders



**MONTHLY TRIP-TEST and general inspection proves adequate for three-phase 16.5-kv., 5,500-amp. interrupting capacity air circuit breakers. Deionizing chamber is raised out of the way on one pole while operator examines main contact; metal fence in front safeguards worker**

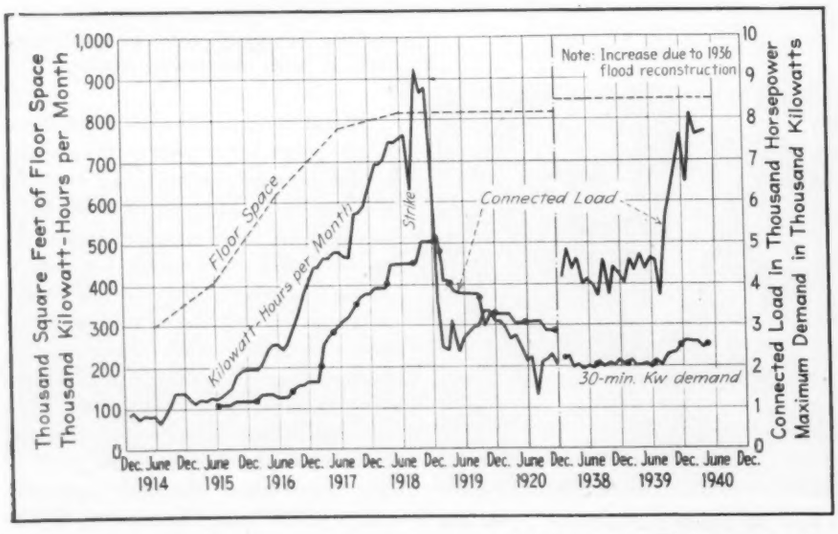
Operating experience of from three to six years with twelve three-phase Westinghouse "Deïon" air circuit breakers on 16.5-kv. distribution feeders at its Torrance Avenue substation has indicated to Southern California Edison Company, Ltd., that the breakers are safer and less expensive to inspect, maintain and repair. The maximum number of operations per year on any one breaker was 112. Automatic openings per year average about two per breaker—24 total—with interrupted currents approximating 8,700 amp. maximum, 2,330 amp. minimum.

# INDUSTRIAL ENGINEERING

## Three-Shift Production Restrains Demand Rise

The advantages of three-shift operation in the production of war material to the manufacturer and to the power company from which he obtains his electrical supply are well illustrated in the accompanying chart from an Eastern arms plant. The record extends without a break from the opening of the World War in 1914 to the post-armistice period of 1920, and is resumed in 1938. In the former period the floor space was increased from 300,000 sq.ft. to 815,000 sq.ft. and the energy consumption per month rose from 85,000 to 925,000 kw.-hr. just before the November, 1918, armistice. During this period energy was supplied to the plant through several metering points and there were no instrumental records of total demand available for charting, so the connected load in horsepower was plotted from month to month. This rose from 1,100 hp. in June, 1915, to a peak of 5,150 hp. in December, 1918. Apparently a portion of the connected load was cut off from the plant in relation to billing when the armistice occurred.

In 1936 the floor space was increased to 845,000 sq.ft. as the result of a flood which inundated a considerable portion of the plant. During 1938 and 1939 the supply of energy to the plant was reviewed and a centralized metering installation provided. With the outbreak of the present war in Europe in September, 1939, it soon became necessary to increase the productive equipment to a point where the connected load aggregated 5,650 hp. Expansion of production soon required 24-hour-per-day operation, and this brought the monthly energy consumption to a peak of 810,000 kw.-hr. at the end of last winter, the maximum demand, however, rising only from about 2,100 kw. to 2,600 kw. Transfer of certain departments to another location late in the spring reduced the demand and consumption slightly. The economical use of plant and capital investment by three-shift operation appears striking from examination of these curves.




**ADVANTAGES of three-shift operation accrue to war industry and supplying utility alike**

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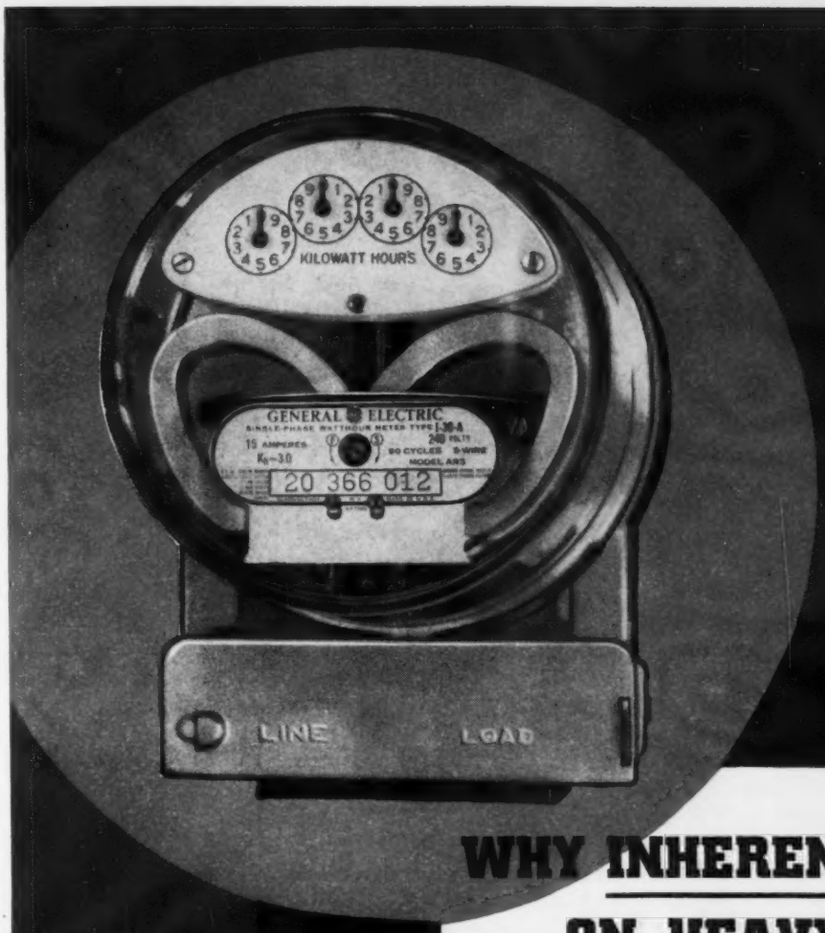
## Power Supply to Pumping Station

By A. P. SCHNYDER
Electrical Engineer for George F. Hardy, Consulting Engineer, New York, N. Y.

The water supply for the newsprint mill at Lufkin, Tex. (ELECTRICAL WORLD, August 10, 1940, page 56), comes from five artesian wells, the nearest of which is 4½ miles away from the mill, and the distance between wells is from ⅔ to ¾ mile. A 200-hp. special hollow-shaft vertical motor drives the deep well pump at each well station.

Electric power is fed from the mill to the wells by stepping up voltage at the mill to 13,200 volts from 2,400 volts and then stepping it down singly at each well station to 480 volts. Step-down transformers are of three-phase construction, but the present step-up bank consists of two single-phase 500-kva. transformers, connected in open delta, with provision for the addition of a third transformer should additional wells be brought in from the same direction.

The 13,200-volt line is of wooden pole and crossarm construction designed for "medium load" territory, with triangular top of pole arrangement, spaced at 42 in., of power conductors which are Copperweld No. 6A. The poles are creosoted Southern yellow pine Class 3, 40 ft. high and carry a telephone circuit 8 ft. from the top, using No. 8 extra high strength Copperweld wire to fit in




# WHY INHERENT ACCURACY ON HEAVY LOADS?

A WATTHOUR meter with *inherent* accuracy on heavy loads is desirable because such a meter requires little compensation to achieve straight-line characteristics. This is important because exact and complete compensation is practically unobtainable. Thus, the aim in meter design is to reduce errors—and therefore, the need for compensation—by making the unit inherently accurate.

Since the chief cause of *inherent error* in registration of heavy loads is the damping torque resulting from the current-coil flux—and this error is directly proportional to the rotor speed—it stands to reason that a meter with low nominal speed and low useful current flux is inherently accurate on heavy loads.

And that is why these features—characteristic of General Electric meters since 1926—still are the basis of the inherently accurate I-30 line.

601-4

GENERAL ELECTRIC

strength the established span of 550 ft. Power conductors are carried on porcelain, pin-type insulators having 42-kv. wet and 72-kv. dry flashover value. Telephone insulators are used for the No. 8 wires.

The line is ungrounded except at terminal points, where ground connections are made between pole-mounted lightning arresters and grounding rods. The line follows the right-of-way of the water pipe-line, but poles have been offset reasonably to obviate possible softening of ground from pipe leaks around the pole footings. Cost of the line erected in place, excluding right-of-way or clearing of same, amounts to $1,050 per mile, as compared with at least three times that much for an underground system.

Since lightning is very frequent in the territory and also extends over the greater part of the year, protection against it was dictated to be the most thorough for this kind of service. It comprises a special 2,400-volt "Thyrite" and capacitor equipment for the feed line out of the mill to the step-up transformers, a Thyrite assembly on the high-tension side of the latter, pellet arresters on the 13,200-volt side of each step-down transformer and finally a 440-volt protector and capacitor assembly at the points of entrance of transformer leads into pump houses.

Incidentally, the 13,200-volt line is tied in with the utility system near the step-up transformer bank, the tie being made with a pole-top disconnecting switch, manually operated, whenever the mill power plant is out of service, to obtain a small block of power to operate essential services such as lights, shops and, possibly, one well.

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## Modernizing a Heat Treating Department

By J. V. DEMPSEY
Power Sales Engineer Central Vermont Public Service Company, Claremont, N. H.

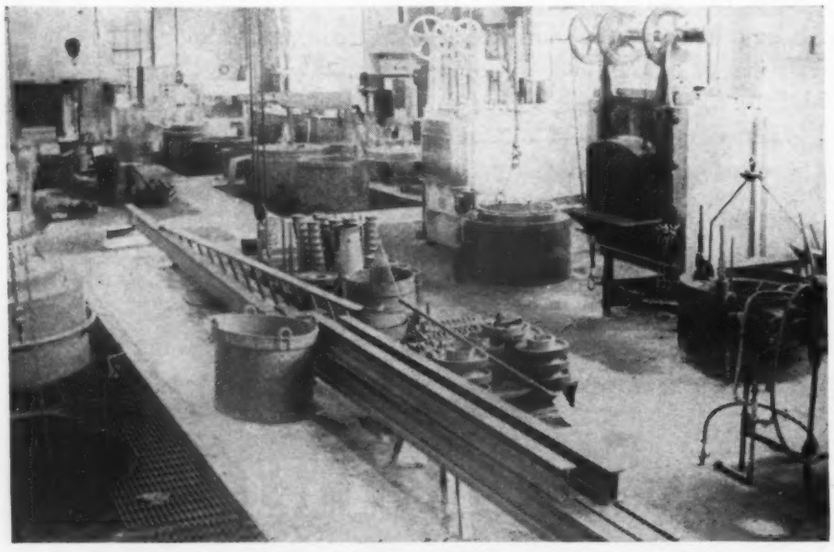
In the search by machine tool manufacturers for accurate and speedy production methods to serve a mechanized world clamoring for deliveries, special attention is being given to the prevention of "bottlenecks" in production by heat-treating departments. At the Jones & Lamson Machine Company plant in Springfield, Vt., the rush of business during the past two years has required the renovation and modernization of the entire heat-treating department to provide a speedy, uninterrupted flow of work through it. Pack-type oil-fired carburizing furnaces have been replaced by "Homo Carbs," following the trial of an initial 85-kw. unit last February, which led to the purchase of a duplicate unit inside of two weeks. The first unit eliminated three oil-fired furnaces, the heat treater stating that the first "Homo Carb" could turn out in eight hours certain work previously requiring about 24 hours with oil firing, and by eliminating an intermediate step on certain jobs 24 hours was saved. All oil firing became unnecessary with the addition of the second electric unit, and with the exception of a few small gas-fired tool hardening furnaces the heat-treating department has become 100 per cent electric.

During the past year all major furnaces purchased have been electric, including 274 kw. in "Homos" and "Homo Carbs" and a 45-kw. Westinghouse box type unit. In connection with the modernization, a single large pit has been made in the heat-treating department floor to accommodate the four "Homo Carbs," installation being on concrete pedestals which raise the furnace bottoms above the pit floor to facilitate maintenance of the circulating fan motors below the furnaces, and give a uniform height above the floor level of the 18- to 64-kw. furnaces. Projection of the furnaces 2 or 3 ft. above the floor facilitates charging and removing loads by a single monorail hoist.

### *Wiring Flexibility*

In increasing the wiring capacity for the additional equipment installed a 1,500-amp. bus-way feeder was installed from the plant transformers for the full length of the heat-treating room, with cross-overs or tap boxes at 25-ft. intervals, from which 1,000-amp. feeders can be taken to either side of the room. At present three feeders are taken to 8-ft. sections of 1,000-amp. step-type bus-way under which the feeder switches for the various circuits are located. One of these distribution sections is designed to serve the Homo furnaces from the side wall of the pit. The two other distribution sections are located on the wall of the heat-treating room above the floor level, one being centered in the south half of the room and serving the two "Homo Carb" furnaces and the Westinghouse tempering furnace. The other is centered in the north half of the room and serves high-speed steel furnaces, a General Electric box type unit and other miscellaneous furnaces in this area. All sections are capable of caring for any future installations made in their areas.

Such distribution centers, using step-type "Buss-Wa," make for a convenient, space-saving and economical method of providing the required electric service and facilitate later additions, removals or relocations of apparatus without difficulty or disturbance to any other electrical circuits.



**MODERN electric furnace layout speeds defense work in machine tool plant**

# No Cutting of Conductors
# No Interruption of Service

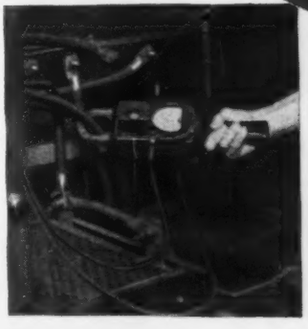
## The NEW G-E Hook-on Volt-ammeter Measures Current Instantly

TYPE AK-1, FOR ALTERNATING CURRENT

JUST hook the instrument around the line and read "amperes." Or, connect leads to the convenient binding posts and read "volts." There's no need for additional equipment of any kind—no necessity for cutting conductors or shutting down equipment.

You can measure alternating current in insulated or non-insulated conductors up to two inches in diameter. Four current ranges, 0–15/60/150/600 amperes, are available at the setting of a plainly marked range-selector switch.

This low-priced instrument is small enough to get into tight places, light enough to be carried on a lineman's belt, and accurate enough for a great variety of measuring jobs.

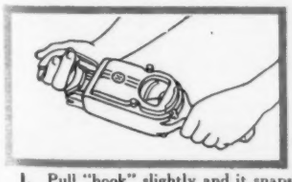


### A Single Set-up for Current and Voltage

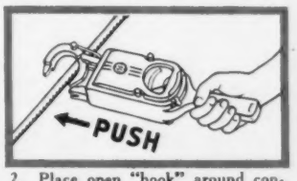
Two voltage ranges, 0–150/600 volts, are also provided. Just set the switch to the desired voltage range, then connect leads to the terminals on the front of the instrument. (Voltage leads are furnished with each instrument.)

Leaving the voltage leads connected does not affect current readings. Just read the "amps," then flick the switch and read "volts."

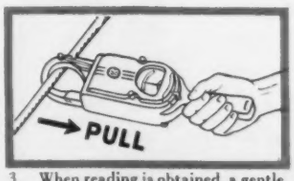
### PUSH-PULL OPERATION GIVES TRIGGERLESS SAFETY



1. Pull "hook" slightly and it snaps open. No trigger to pinch fingers.




2. Place open "hook" around conductor; a slight push on handle snaps it shut, and instrument is ready for reading.




3. When reading is obtained, a gentle pull on handle opens dovetail joint and releases conductor. No trigger connected to live parts.

### Send for This Free Bulletin Today

*Our bulletin GEA-2950 gives complete information about this time-saving instrument. Call your G-E Office or write General Electric, Schenectady, N. Y.*

# GENERAL ELECTRIC

602-11

# NEW ENGINEERING IDEAS

## Demand Totalizer Has Dual Function

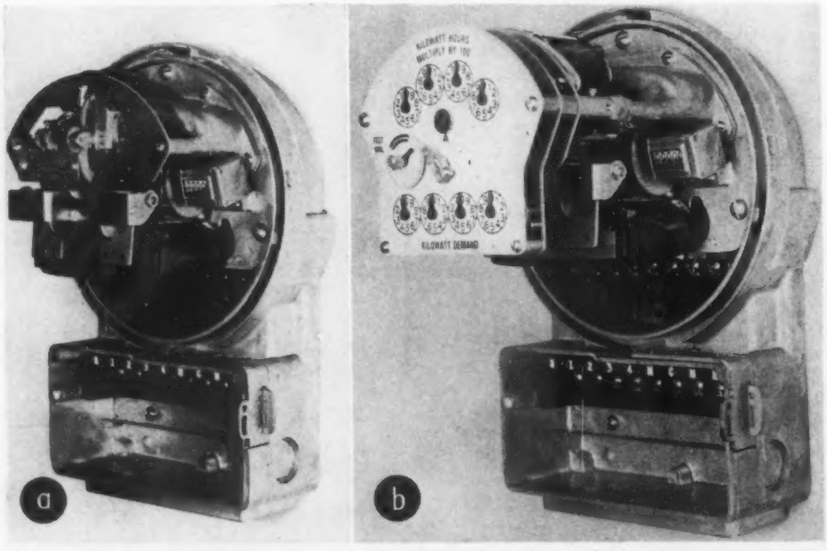
By L. A. PAGANO
Assistant Engineer Consolidated Edison Company of New York, Inc.

Lack of flexibility in conventional demand meters and need to eliminate special mechanisms when coincident demand of more than two meter circuits was to be metered led to a new development that may be used either as a demand meter or a relay and will accommodate up to four meters. Conversion of the device from a relay to a demand meter simply requires the removal of the contact mechanism and the installation of a conventional demand register.

Developed by the General Electric Co. at the request of and with the co-operation of the Consolidated Edison Company, the device is known as the type "MD1D2" totalizer.* It has two duplex operating coils, each of which may receive impulses from two watt-hour meters. The two operating coils actuate a differential mechanism which engages the contact device or demand register.

Cyclometer counters, geared to each side of the differential mechanism, are used for testing purposes and for checking with the kilowatt-hour registration of the meters involved in the demand measurement. The grid supporting the operating elements can be removed from the base without dismounting the totalizer or disturbing the external wiring and the terminal chamber is provided with knockouts which accommodate flexible or rigid conduit for the impulse wires. Totalizers are equipped with the standard "A"-base watt-hour meters.

*For application of this device see "Demand Totalized for Housing Project," page 49.




**NEW DEMAND TOTALIZER for multi-meter installations can be converted from relay to demand meter by removal of contact mechanism (a) and installation of conventional demand register (b). It will accommodate up to four meters**

Where only two watt-hour meters are involved in the demand measurement a type "MD7D2" totalizer, which differs from the type MD1D2 only in that it has one duplex operating coil and no differential mechanism, can be used.

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## Thermosheet Supplies Oven Heating Data

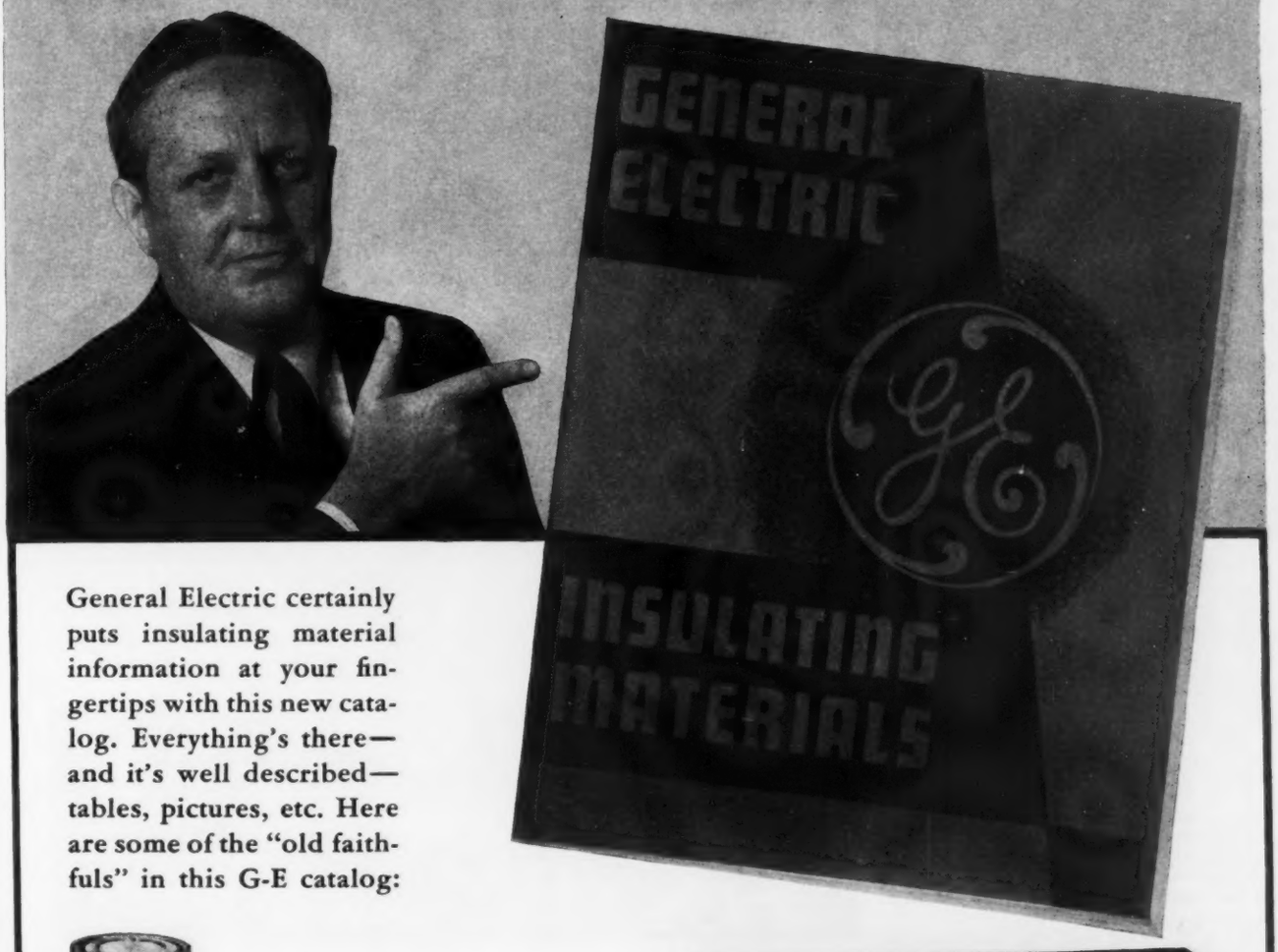
By T. H. SWISHER
Edison General Electric Company, Inc., Chicago, Ill.

Because there are now in general use seven distinct methods of measuring oven temperature, no two of which would measure the same average temperature for any one particular oven, Mrs. Homemaker cannot, at this time, even hope to get perfect results from all her recipes. Some must be perfected by the trial-and-error method. These various methods are as follows:

1. Household-type mercury or bimetallic thermometers.
2. One bare thermocouple in the center of the oven.
3. Five bare thermocouples in a horizontal plane.
4. One "shielded" thermocouple in the center of the oven. (There are at least three different types of "shields.")
5. Five "shielded" thermocouples in a horizontal plane.
6. Five thermocouples each with a "heat-absorbing disk" attached.
7. The "Thermosheet."

With the above thoughts in mind, an oven temperature measuring device known as a Thermosheet has been developed. It consists of a 10x12-in. sheet of 0.031-in. stainless steel, blackened on top and bright on the bottom, to the center of which is attached a 24-gage (0.020 in.) iron-constant thermocouple.

# IT'S EASY TO FIND WHAT I WANT IN THIS NEW G-E INSULATING MATERIALS CATALOG



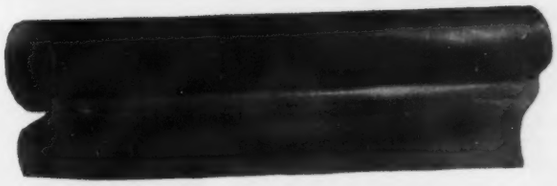

General Electric certainly puts insulating material information at your fingertips with this new catalog. Everything's there—and it's well described—tables, pictures, etc. Here are some of the "old faithfuls" in this G-E catalog:

**G-E 1201 GLYPTAL RED**

The standard insulating finish of the transit industry.

**G-E VARNISH**

Any type I need—and General Electric's been making varnish for over 30 years. Good? *It has to be!*



**G-E VARNISHED CLOTH**

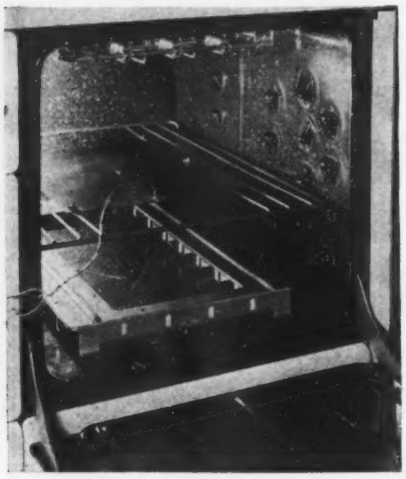
Cloth chosen for its strength, evenness of weave, lack of dressing and sizing. Varnish developed by extensive research. Treating accomplished by ⅓-mile trip through newest-type vertical treating ovens.

**G-E Tapes, Paper, Fiber, Mica—yes, everything's there**

And here's something you shouldn't forget—you can get all of these G-E Insulating Materials from your local G-E Merchandise Distributor. That means fast delivery service.

Get your copy of this new catalog now. Write to your nearest G-E Merchandise Distributor or to Section M-0139, Appliance and Merchandise Dept., General Electric Co., Bridgeport, Conn.

**GENERAL ELECTRIC**



**THERMOSHEET permanently attached to an oven sheet for production testing**

Following is a list of the advantages of the Thermosheet method of testing:

1. The black top takes into account the effect of radiant heat on the cooking of food, particularly in ovens with top heat.
2. The bright bottom resembles the finish of an aluminum pan.
3. The oven air circulation with the Thermosheet in place is similar to circulation with food in the oven. This tends to make the thermostat performance under test conditions more nearly like that of a loaded oven than is the case with bare or shielded thermocouples.
4. The radiation with the Thermosheet in place is similarly more like that of a loaded oven than when using bare or shielded thermocouples.
5. The heat mass of the Thermosheet being greater than that of bare or shielded thermocouples makes the arithmetical average of the maximum and minimum temperature of a heating cycle more nearly the weighted average than that of bare or shielded thermocouples.
6. On the other hand, the heat mass of the Thermosheet is considerably less than the smallest food item ordinarily cooked in an oven, namely, a sheet of cookies. Thus the Thermosheet is easily capable of indicating any tendency to burning food that might be caused by the peaks of an excessively high oven temperature amplitude.
7. Where a manufacturer is testing his own ranges in production, the Thermosheet may be permanently attached to an oven shelf, thereby eliminating variables arising from irregular placing of the temperature-measuring device. Where different makes of electric ranges are being tested, the Thermosheet is placed on an oven shelf. The black side is of course always up.
8. The use of a thermocouple eliminates errors which occur with thermometers which have to be read with the oven door open. There is always some drop in temperature between the time the door is opened and the time the reading is taken.
9. The Thermosheet is the easiest to use of any of the various methods. It is certainly far easier to install than five thermocouples.
10. When the Thermosheet is used with a recording instrument a permanent record of the oven temperature is obtained automatically.

The Thermosheet has already been adopted by several large manufacturers of electric ranges, and also by a number of utility companies and testing agencies. All indications are that they have found the Thermosheet a practical and satisfactory standardized method for accurately measuring oven temperature. If all agencies would adopt the same method, the already high standards of excellence of electric range ovens would be greatly enhanced.

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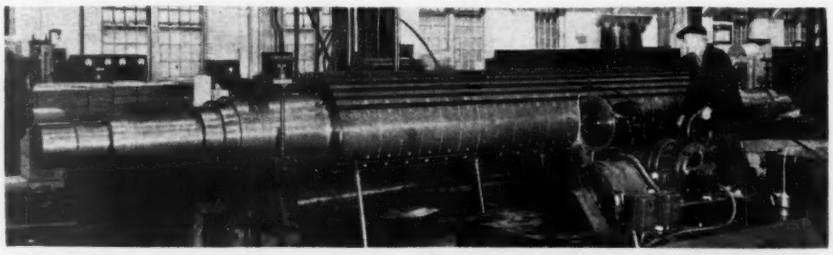
## Reduce Vibrations of Two-Pole Machines

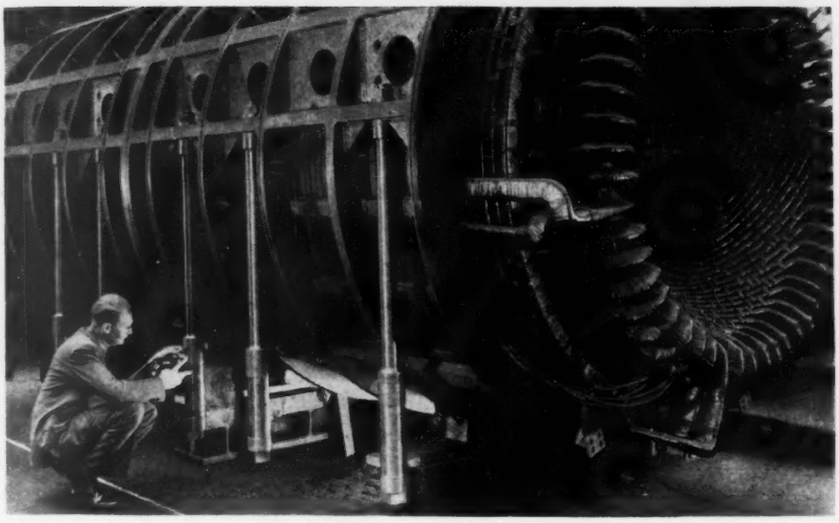
Rotor and stator vibrations inherent in all two-pole turbine-generators have been reduced 80 per cent by engineers of the Westinghouse Electric & Manufacturing Company.

A long and relatively slender two-pole rotor has a tendency to sag twice each revolution because of the deep slots cut on two opposite sides for the field winding. The double-frequency vibration thus set up, although small, may have an adverse effect on the bearings, collector rings and brushes.

Removing metal in the unslotted sectors of the rotor by cutting narrow slots at intervals effectively reduces its rigidity to compensate for the lengthwise slots, but has relatively little effect on the magnetizing flux in the rotor body. This solution has reduced shaft movements of seven- or eight-thousandths to less than one-thousandth inch.

Due to the tremendous pull exerted by each pole, the stator takes a slightly elliptical shape, the ellipse revolving in step with the rotation of the two-pole field, and again creates a 120-cycle vibration. Unable to cure this ailment at the source, Westinghouse engineers designed a system of flexible supports to limit the passage of vibration to the foundation. Two sets of flexible supports, one of which permits the stator to "breathe" horizontally but not vertically, and the other permitting vertical but not horizontal movements, have reduced the vibration transmitted to the frame by 80 per cent. The total 120-cycle noise has been reduced below ordinary noise levels in a power station.

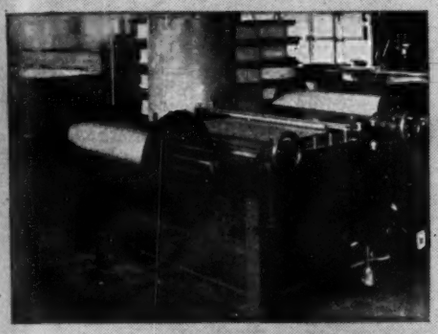




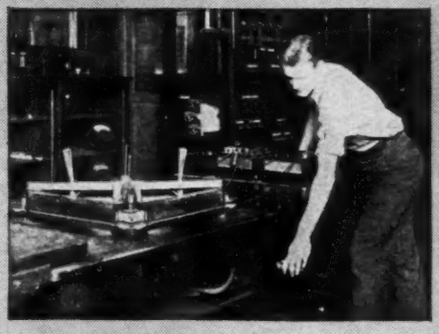
**ROTOR AND STATOR vibrations inherent in two-pole turbine generators have been reduced 80 per cent by the methods illustrated. Rotor is slotted (above) to provide equal rigidity on the two major axes. Flexible supports on the two-pole, 3,600-r.p.m. turbine-generator stator (below) reduce the amplitude of double-frequency vibration transmitted from stator core to foundation**

# VAGNER POWER TRANSFORMERS

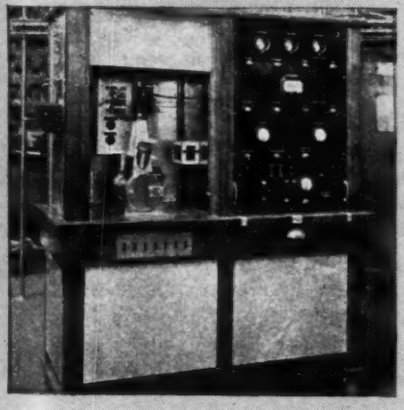
## ACCURATE TESTING
## ASSURES USER SATISFACTION



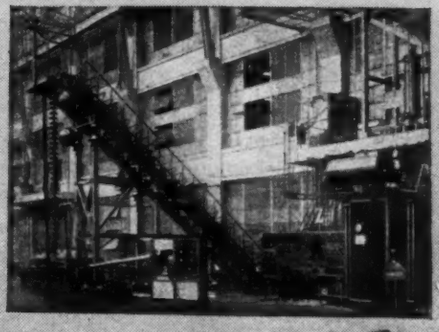
Insulation-testing machine used to determine if insulation has proper characteristics and will meet high Wagner specifications.



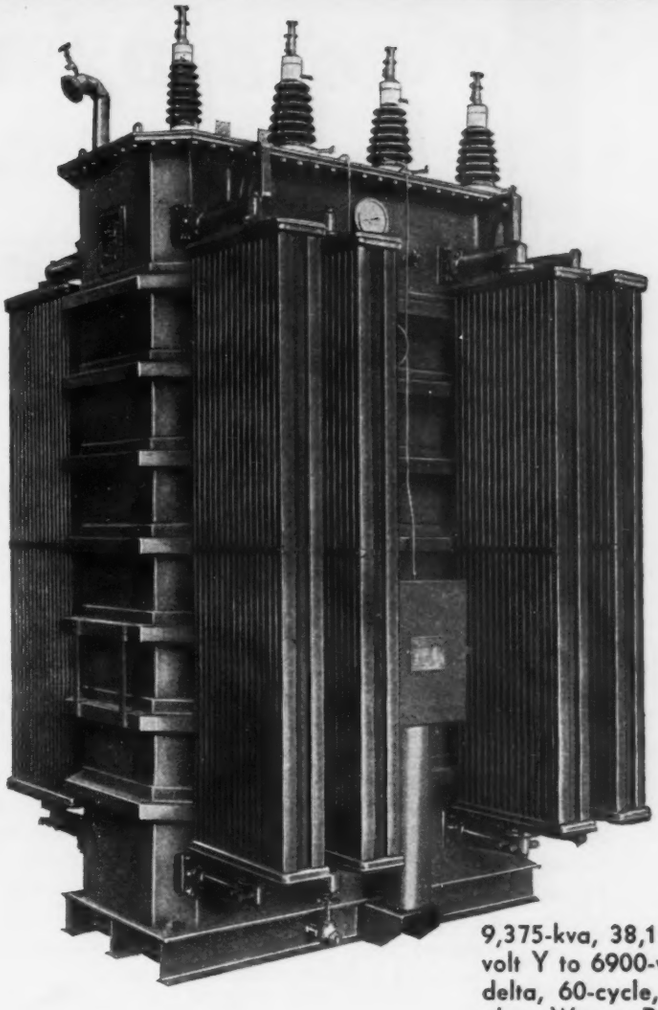
"Epstein test" of Silicon Steel. No shipment from manufacturer is accepted by Wagner until sample sheets have passed rigid Wagner tests for specified electrical and physical properties.



Cathode-ray oscillograph. A most valuable instrument in determining the wave-shape and form of the current when impulse-testing transformers.



Surge Generator. Used primarily for impulse-testing transformers and special testing of various types of installations.



9,375-kva, 38,100-volt Y to 6900-volt delta, 60-cycle, 3-phase Wagner Power transformer with inert gas equipment.

### TAILORED TO MEASURE

Wagner Electric Corporation, with its large plant and vast manufacturing facilities, is particularly well equipped to build power transformers "tailored to measure"— regardless of the size or type.

Every Wagner transformer incorporates features and improvements that have been developed through almost fifty years of transformer manufacturing experience.

Broad experience . . . modern manufacturing facilities . . . proved performance—these assure you that Wagner power transformers will give efficient, dependable service with minimum up-keep.

Wagner experience is not limited to one type of transformer. Wagner manufactures in addition to power transformers, a complete line of distribution transformers (single or three-phase, rural-line, and air-cooled) and type Y-H constant-current regulator.

Specify Wagner transformers on your next request for quotation —meanwhile write for descriptive literature on Wagner transformers.

T40-9

*Send for* COMPLETE LITERATURE

**Wagner Electric Corporation**

6400 Plymouth Avenue, Saint Louis, Mo., U.S.A.

TRANSFORMERS • MOTORS • FANS • BRAKES

# LOAD BUILDING

## Horizontal Broiler Designed by Utility

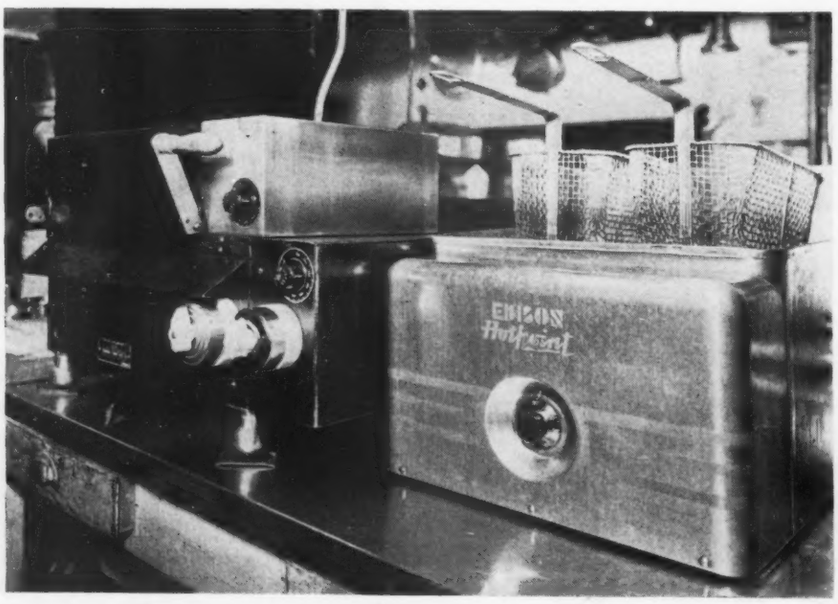
A double-fire, horizontal electric steak broiler, designed by Portland General Electric Company for The Broiler, a Portland, Ore., restaurant, has, according to the customer's own statement, proved to be superior to the fuel-fired equipment which it replaced.

The unit, as illustrated, has an Edison charcoal-type broiler in the base, a 4-kw., cast-in Calrod unit. Control is by thermostat and three-heat switch. The cover contains 3.6 kw. of Calrod heating units giving a wattage density of 10.3 per sq.in. Transite, $\frac{3}{4}$ in. thick, is used for insulation on all four sides of the cover, and a thermostat bulb is fastened under a metal shield at inside center. About $150 went into the unit, the labor and material being furnished at cost.

Over an eight-week period, during which an average of 200 steaks were broiled per day, consumption averaged 139 kw.-hr. per week, and in high and low weeks was 170 and 110 kw.-hr. respectively.

W. M. Deane of The Broiler says: "After three months of service I find that this broiler broils steaks that are juicier and with at least 30 per cent less shrinkage, and it is so designed that it holds the smoke while the steak is being broiled. The cost of operation is lower than that of our former installation and has averaged $5.28 per month."

Identified with this installation was Daniel Brown of Portland General Electric.



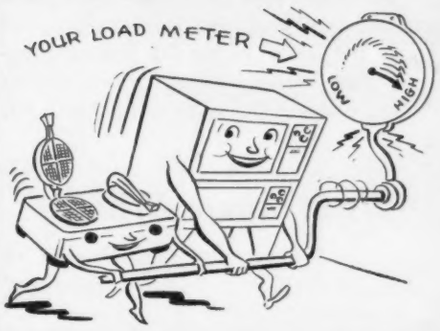
**LOCALLY designed broiler installed for "The Broiler," Portland restaurant; a previously installed electric fryer appears at right**

## Uses Fluorescent for Load Building

By W. J. BURTON
Duke Power Company, Greensboro, N. C.

With the introduction of the more efficient fluorescent lamp the feeling was prevalent among many lighting men that the public would take advantage of this new efficiency only to effect savings in their electric service bills. On the other hand, some engineers took the more progressive viewpoint that by proper promotion fluorescent lighting could be used to raise existing levels of illumination nearer to the values which the "Science of Seeing" had discovered to be most advantageous in conserving human eyesight and in improving the efficiency of employees working under artificial light.

The new quarters of the Security National Bank of Greensboro, N. C., were particularly well adapted for the latter conception of fluorescent lighting. A very low ceiling, for a bank lobby, severely cut up by beams and air conditioning ducts, made the use of conventional suspended fixtures undesirable. At the suggestion of the lighting service department of the Duke Power Company the architect decided to try fluorescent lighting, although at that time there were no applications of fluorescent lamps for general illumination in this section of the country. A design was adopted in which the beams and air conditioning ducts are arranged to form recessed coffers, 11 ft. long, 6 ft. wide and 18 in. deep. In each coffer eight 40-watt fluorescent Mazda lamps are arranged in such a manner as to give uniform distribution of light. In order to obtain the maximum utilization of




# HERE ARE TWO GREAT NEW LOAD BUILDERS FOR YOU — By Edison-Hotpoint

## New Bake Oven is 25% faster— 35% more efficient

YOUR commercial customers will want this great new Bake Oven because it reaches baking temperatures 25% faster, it holds heat 35% more efficiently than previous electric ovens, and it sells at a new low price.

This commercial load is on Main Street too — adjacent to existing facilities. And it's load you can always count on. Write today, now, for complete information.

Signal light reads "Waffles" when current is on.

This temperature control, called the HEAT MANAGER, ends guesswork—provides automatic control.

## At last! The new sensational Edison-Hotpoint Charm Waffle Baker is ready to help increase your revenue

IT had to come—this great Charm Waffle Baker for waffle and coffee shops, restaurants, hotels, hospitals and diet kitchens.

The "Charm" is completely automatic in time and temperature — the operator sets the Heat Manager switch . . . the "Charm" does the rest.

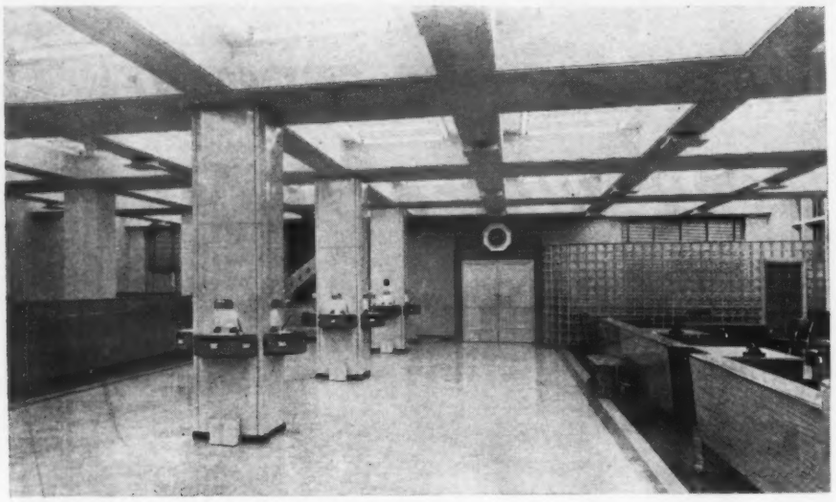
Its streamlined, functional beauty makes it an asset to counter or back bar.

You can count on an increased load with these Edison-Hotpoint Charm Waffle Bakers on your line because people in the food business know they can make greater profits on waffles than on almost any other item of food. The Charm Waffle Baker provides an easier way to make waffles. Edison General Electric Appliance Co., Inc., 5618 West Taylor Street, Chicago, Illinois.

Distributed in Canada by CANADIAN GENERAL ELECTRIC COMPANY, LTD., TORONTO

For sale through Kitchen Equipment Houses

COMMERCIAL ELECTRIC EDISON hotpoint COOKING EQUIPMENT



**BANK SERVED by Duke Power capitalizes on fluorescent to gain average level of 75 ft.-candles**

the light the lamps are mounted exposed on chrome finish Wiremold fluorescent channel, the depth of the coffers serving to shield the lamps from normal view.

In some banks objection had been raised to the stroboscopic effect of this type of lighting, but this was overcome in this case by connecting adjacent coffers to alternate phases of the four-wire, three-phase distribution system employed in the building. The white lamp is used instead of the more common daylight, not only because it makes possible 20 per cent more light, but also as it gives a color of light more in keeping with the spirit of a banking institution.

A total of 292 of the 40-watt lamps are used, producing a level of illumination of 75 ft.-candles, with a variation of less than 2 ft.-candles either way. The coffers are finished in natural colored acoustical board, which, although it does not have the maximum reflection factor, works very well with the exposed lamps and serves to keep the brightness of the exposed portions of the coffers well within comfortable limits. The room gives the impression of being lighted by a series of skylights and the absence of suspended fixtures tends to exaggerate the impression of height in the room.

It is safe to say that this installation has by far attracted the attention of the public more than has any other lighting system installed in this section of the Carolinas and is already directly responsible for two other major office relighting projects in this immediate vicinity, both of which are designed to provide more than 60 ft.-candles of light. Thus it is evident that as the first excitement over the fluorescent lamp dies down office managers and others are recognizing it not as a means of reducing expenses but as an answer to the growing demand for more and better light.

•

## What Lamps Where

As a guide for the selection of lamps for different applications and occupancies the Nela Park engineering department of the General Electric Company offers the accompanying table. Although the table cannot be taken as more than indicatory of the kind of lamp to be used in a given case, owing to the many different considerations in individual installations, yet it does incorporate the latest thinking in lighting application and thus should be of assistance in the proper use of modern light sources.

### Light Sources and Symbols

| | | | |
|---|---|---|---|
| Mazda C (Filament) Lamps | I | G.E.—85-watt RF (Fluorescent) Lamps | RF |
| Mazda F (Fluorescent) Lamps | F | Combination of Filament and Mercury Lamps | IH |
| Mazda H (Mercury) Lamps | H | Generally Not Recommended Practice | O |
| Mazda C (Filament) and Mazda F (Fluorescent) Lamps | IF | | |

| Area to be Lighted | Maintained* Foot-Candles Desired | | | | | |
|---|---|---|---|---|---|---|
| | 5 | 10 | 20 | 50 | 100 | 200 or More |
| **Commercial Lighting** | | | | | | |
| General offices | O | O | I | I-F | F | † |
| Private offices | O | O | I | I-F | F | † |
| Mail and file rooms | O | O | I | I-F | † | .... |
| Service areas, halls, etc. | I-F | I-F | .. | .... | .... | .... |
| Drafting rooms | O | O | O | I-F | F | † |
| **General Lighting** | | | | | | |
| Banks | O | I | I-F | † | † | † |
| Libraries | O | O | I | I-F | † | † |
| Library stacks | O | I-F | † | † | † | † |
| Churches | I | I | I-F | † | .... | .... |
| Museums | O | I-F-IF | I-F-IF | † | † | † |
| Schoolrooms | O | O | I | I-F | † | † |
| Public buildings | O | I | I | F | † | † |
| Hotels | O | I-IF | I-F | † | † | † |
| Art galleries | I | I-F-IF | F-IF | † | † | † |
| Restaurants | I | I-IF | IF | † | † | † |
| **Store Lighting** | | | | | | |
| General | O | O | I | I-F-IF | I-F-IF | † |
| Supplementary lighting | | | | | | |
| Showcases | O | O | I | I-F | F | † |
| Wall cases | O | O | I | I-F | I-F | † |
| Mirrors | O | O | I-F-IF | I-F-IF | † | † |
| Fitting rooms | O | O | I-F-IF | I-F-IF | IF | † |
| Show windows | O | O | O | O | I-IF | I-IF |
| **Industrial Lighting** | | | | | | |
| Production areas | | | | | | |
| Low bays | O | O | I-F-RF | F-RF-H | RF-H | † |
| Medium bays | O | O | I-F-RF-H | I-IH-F-RF | I-IH-H | † |
| High bays | O | O | I-H | I-H-IH | † | † |
| Supplementary lighting | O | O | O | I-F-RF | I-F-RF | I-F-RF |
| Drafting rooms | O | O | O | I-F | F | .... |
| Factory offices | O | O | I-F | I-F | F | .... |
| Receiving and shipping rooms | O | I | I | .... | .... | .... |
| Storage areas | I | I | I | .... | .... | .... |
| Aisles and passageways—stairways | I | I | † | .... | .... | .... |
| Yards | I-H | I-H | † | .... | .... | .... |

* Maintained foot-candles means the average level throughout life of the installation. Depreciation of lamps and equipment, and dirt accumulation throughout life require new equipment to develop at least 50 per cent more than these values, when first installed.

† These levels of illumination, while not generally used, are in keeping with the results of engineering studies. However, they are in the realm where specific recommendations from competent lighting specialists should guide the choice of light source.

# IN THE FIELD AND IN THE SHOP

THIS Bridge meets the needs of the public utility engineer for power factor and capacitance tests on transformers, bushings, porcelain insulators, cables and generators.

The G-R Type 740-BG Capacitance Test Bridge is finding wide acceptance because it is

**PORTABLE**—weighs only 19 pounds

**SAFE**—maximum of only 80 volts on sample

**ACCURATE**—capacitance 1%; power factor 0.075% p.f. or 0.75% p.f.

**CONVENIENT**—direct-reading with electron-ray null indicator

**COMPACT**—self-contained with built-in power source for 115-volt 60-cycle operation

**WIDE RANGE**—dissipation factor (R/X) 0 to 50%; capacitance 5 $\mu\mu$f to 110 $\mu$f

**INEXPENSIVE**—only $160.00 complete

***Write for New Bulletin 622***

# GENERAL RADIO COMPANY

**CAMBRIDGE, MASSACHUSETTS**

Branches in New York and Los Angeles

# NEW EQUIPMENT

## Discharge Counter

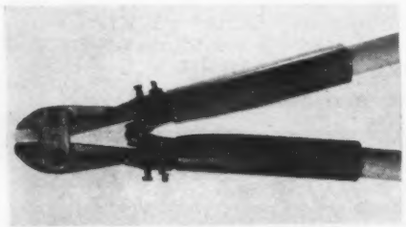
A discharge counter that records the number of lightning discharges passing through station-type or medium-voltage distribution type lightning arresters, developed in response to a request from one utility, is now available. Installed between the arrester ground terminal and ground, the instrument has no measurable effect on the protective characteristics or protection level of the arrester. The counter mechanism is inclosed in a socket-type case with glass cover and locking sealing ring. Each unit comes equipped with mounting bracket and a terminal for cable connection.

Lightning discharge counter; counts number of lightning-arrester operations. **General Electric Co., Schenectady, N. Y.**

•

## Bolt Cutter

Bakelite-covered guards are pressed over the ferrules of this bolt cutter, then poured full of insulating compound. Compound adds to insulating qualities of guards and also protects the tube from being crushed if a heavy object falls on it.



Insulated bolt cutters; mounted on 1½ x 3-in. laminated oak handles. **James R. Kearney Corp.**, St. Louis, Mo.

•

## Luminaire

Type "PL-500" luminaire; in 300-500-watt size. **Westinghouse Elec. & Mfg. Co.**, East Pittsburgh, Pa.

New semi-indirect luminaire with plastic basin is offered for general illumination of commercial buildings.

•

## Flue Gas Analyzer

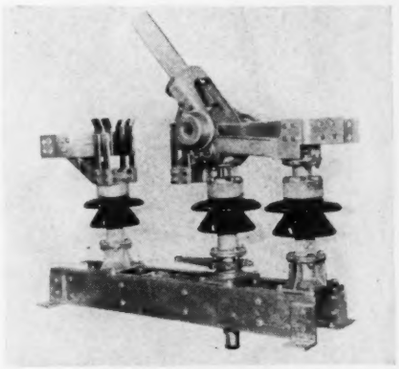
For measuring the percentage of carbon dioxide in the flue gases of boiler furnaces, this company has brought out a chemical type analyzer. Gas-sampling equipment includes primary flue filter with replaceable filtering thimble. Flue gas sample of known volume is pumped to instrument by hand with rubber bulb and trapped in the instrument by pulling off the sampling hose. Instrument is turned upside down to mix sample with absorbing reagent; suction created pulls absorbing fluid up an amount equal to carbon dioxide absorbed.

"Fyrite" analyzer. **Bacharach Industrial Instrument Co.**, Pittsburgh, Pa.

**BUYING ELECTRICAL EQUIPMENT?—"Electrical World" *Electrical Buyers Reference* is a convenient place to look first for names, addresses and products of manufacturers.**

## Disconnecting Switch

Flexible leads have been eliminated from this disconnecting switch; 4-in. square tubular blade is used, with high-pressure contacts being made at both ends across the corners of the tube. Switch has only three moving parts, two of which make up the 45-deg. bearing that turns the tube to break the contacts before the blade begins to open. Inclosed spiral springs counterbalance the blade structure.



Type "MK-39" 23-kv., 3,000-amp. switch. **Delta-Star Electric Co.**, Chicago, Ill.

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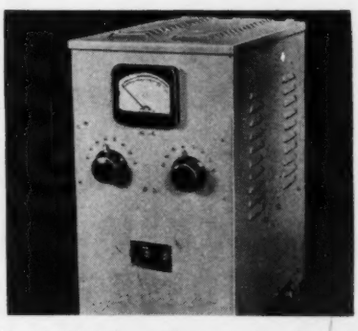
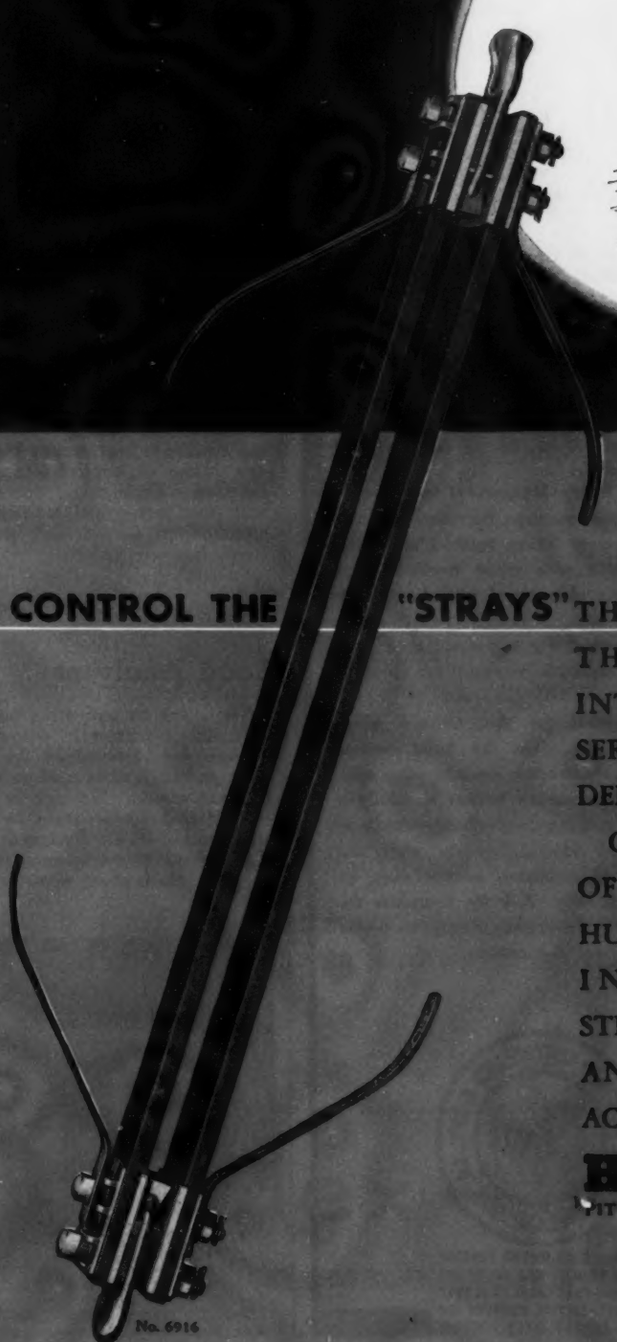
## Portable Rectifier

New unit is designed to provide d.c. from a.c. source for testing purposes, including 110- or 220-volt refrigeration equipment, business machines, electro-magnetic



Model "SP-20" rectifier; capacity, 30 amp. at 32 volts d.c. and 20 amp. at all other voltages. **Mellaphone Corp.**, Rochester, N. Y.

"ROLLING STONES GATHER NO MOSS"




**—SO CONTROL THE "STRAYS" THAT TRESPASS ON YOUR LINES!**

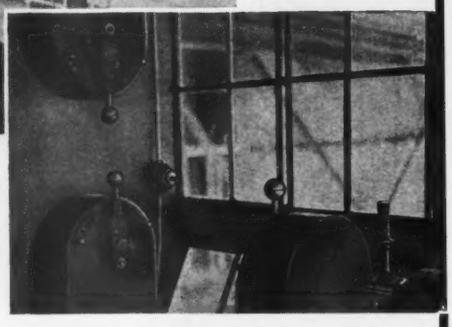
THESE WANDERING SURGES THAT INTERRUPT YOUR SERVICE CAUSING SERIOUS DAMAGE AND COSTLY REPAIRS, DEFINITELY "GATHER NO MOSS."

CURB THE WANTON DESTRUCTIVENESS OF THESE "OUTLAWS" BY INSTALLING HUBBARD DUAL MEMBER WOOD STRAIN INSULATORS, DOUBLE PLANK STRUCTURES, WOOD CROSS ARM BRACES AND HUBBARD HIGH TENSION LINE ACCESSORIES!

**HUBBARD AND COMPANY**

PITTSBURGH . . . OAKLAND CALIFORNIA . . . CHICAGO

**"HANG THE LOAD ON HUBBARD HARDWARE"**



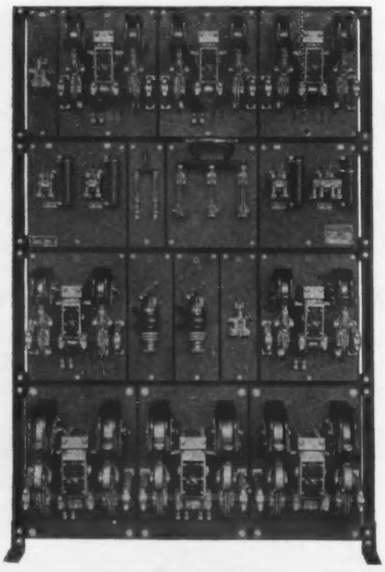
with

# EC&M

## FREQUENCY RELAY MAGNETIC CONTROL

HERE is another installation of EC&M Frequency Relay Magnetic Control for a 2-motor bucket crane operated by A-c wound-rotor motors. Extremely smooth and accurate operation is possible because the Frequency Relay method of control permits weak values of counter-torque for very slow speeds when needed. This enables the operator to manipulate the bucket without danger of overshooting or landing hard.

The advantages of Frequency Relay Control are particularly important on cranes used to unload cars or ships in which slow, accurate control is essential for clean-up operations or when entering hatchways.



EC&M Control for A-c Cranes gives smooth operation. On the hoist motion, counter-torque lowering permits—the ability to land the empty bucket carefully—fast bucket opening to discharge the load quickly — and the ability to stop the motors without imposing severe duty on the holding brakes. Ask for complete details on EC&M Frequency Relay Magnetic Control for your A-c cranes.

THE ELECTRIC CONTROLLER & MFG. CO. E&M CLEVELAND, OHIO

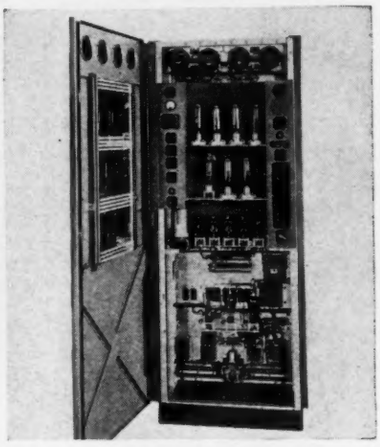
HEAVY DUTY MOTOR CONTROL FOR CRANES, MILL DRIVES AND MACHINERY • BRAKES • LIMIT STOPS • LIFTING MAGNETS AND AUTOMATIC WELD TIMERS.


devices, etc. Output voltage may be adjusted by knobs on front panel in steps of 32, 110, 115, 120, 210, 225, 240 volts. Two mercury-vapor tubes are used to give full-wave rectification of single-phase line. Output voltage is said to remain practically constant from no load to 25 per cent overload.

•

## Radio Transmitter

New radio transmitter for emergency communication services has been designed to provide economy of operating and maintenance time. Electrical components are assembled on central member of vertically mounted steel plates. Components radiating maximum heat occupy highest positions and shape of control knobs varies with function. Tuning and operating controls, with test meter and transfer switch, are mounted on narrow side panels flanking front door of cabinet.



100-250-watt radio transmitter; 550 to 2,750 kc. frequency range available. **Western Electric Co.**, New York, N. Y.

•

## Load Analyzer

There are no indicating pointers on this portable instrument; power factor and voltage are determined by revolving a knob and the values read on corresponding circular scales. Wattage is read from a proportional linear scale by observing a stroboscopic disk. Designed primarily for single-phase measurements, it can also be used for three-phase analysis. Eight cur-

"Knopp" load analyzer. **Electrical Facilities, Inc.**, Oakland, Calif.

# 37 Conductor Latox Cable 3 Cigarettes in Diameter

You know that LATOX insulated cables are small but do you realize that a 37 conductor #16 solid LATOX cable made according to I.M.S.A. Specification No. 16 is only three cigarettes in diameter. That's getting the diameter down close to an "irreducible minimum."

Simplex - LATOX insulated cables are only three quarters as large as cables insulated with conventional rubber insulation. LATOX cables can be smaller and still be dependable because the rubber insulation on each conductor is **all** insulation.

Simplex - LATOX insulation reduces cable weight and bulk. We designed it that way. In short, it was developed in Simplex laboratories to meet a definite need caused by the conditions under which you work to-day.

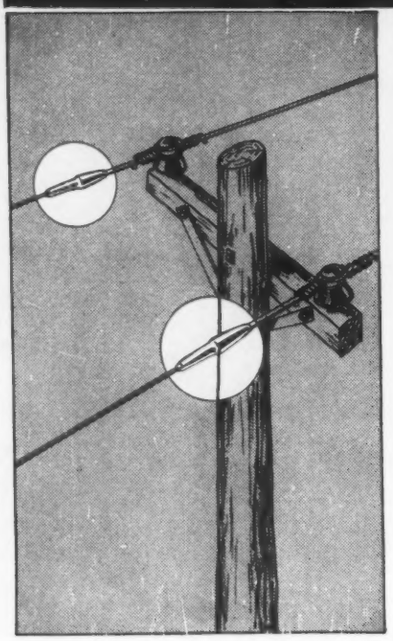
If you want more information about this modern answer to the problem of duct space just a card will bring you the LATOX catalog.

**Simplex Wire & Cable Co., 79 Sidney Street, Cambridge, Mass.**

# Simplex – LATOX

**Thin insulation made directly from rubber latex**

modernize
YOUR
DISTRIBUTION
PRACTICE—



Urban construction where line drops portion of load and smaller wire size will carry current flowing through the rest of circuit.

RELIABLE
STRAIGHTLINE
REDUCERS . . . .

Save money and clean up appearance while eliminating a double dead-end. Sag of larger wire is only increased two or three inches as spans of city distribution are short.

Reliable
ELECTRIC COMPANY
OVER 30 YEARS SERVICE TO THE UTILITIES
3145 CARROLL AVENUE : CHICAGO, ILLINOIS

rent ranges from 0.5 to 100 amp. are provided on the multi-range instrument and potential ranges from 120 to 480 volts. Power-factor measurements can be made from 10 per cent lag to 85 per cent lead; wattages from 10 to 48,000 watts, depending on the voltage range of the instrument.

•

## Pyrometer

New type of pyrometer is offered for checking oven temperatures, such as thermostats, waffle irons, electric grilles, roasters and the like. Flush mounted in its stand, the instrument has exposed binding posts to accommodate the thermocouple, No. 18 gauge wire with asbestos insulation.

"Alnor" pyrometer; offered in a range of 0-500, 0-600 or 0-800 deg. F. **Illinois Testing Laboratories, Inc.**, Chicago, Ill.

•

## Tungsten Contacts

Tungsten electrical contacts. **Metroloy Co.**, 57 East Alpine St., Newark, N. J.

This company is now manufacturing electrical contact points from highly fused tungsten metal, which is said to eliminate excessive oxidation or pitting during operation periods, as well as film coatings on metal surfaces while apparatus is not operating.

•

## Insulation

"XTE-30" extruded tubing; sizes from No. 20 to ⅝ in.; five colors. **Irvington Varnish & Insulator Co.**, Irvington, N. J.

High dielectric strength of this extruded tubing—dry, 750 volts per mil up to 0.022 in.; wet, 350 volts per mil up to 0.022 in.—is said to permit relatively small outside diameters. Tubing is reported to remain smooth and intact when heated in transformer oil for 48 hours at 220 deg. F., to withstand soldering temperatures and not to support combustion. It can be flexed on itself with the wire inside without cracking, according to the makers.

•

## A.C. Ammeter

Model "670" a.c. ammeter. **Triplett Electric Instrument Co.**, Bluffton, Ohio.

A.c. ammeter is one of a series of new line of testing instruments offered by this company as single units or in combination. Self-contained current transformer permits measurements on these ranges: 0-1; 0-2.5; 0-5; 0-10; 0-25.

## Study Lamp

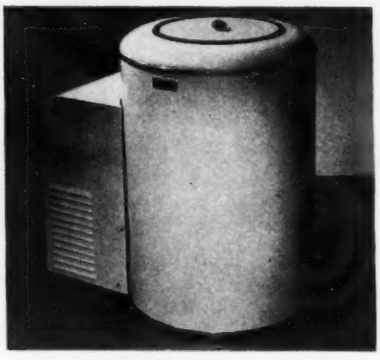
Light from a 100-watt bulb is projected through a Polaroid sheet by a mirror-like reflector under this study lamp shade. Ventilation slots are provided to carry away the heat produced by the bulb and leave the column cool to the touch.

Study lamp "No. 100." **Polaroid Corp.**, Cambridge, Mass.

•

## New Appliance

Household frosted food lockers are a new entry in the electrical appliance field. Refrigerant is circulated in a hollow cylinder surrounding the food compartment to maintain a temperature of zero or below as set on the control dial. Compressor is mounted at one side of the unit and is driven by a ¼-hp. capacitor motor. Energy consumption is said to be about that of an ordinary refrigerator.



"Deep-Freeze," household frosted food locker. Deep-Freeze Div., **Motor Products Corp.**, 2301 Davis St., North Chicago, Ill.

•

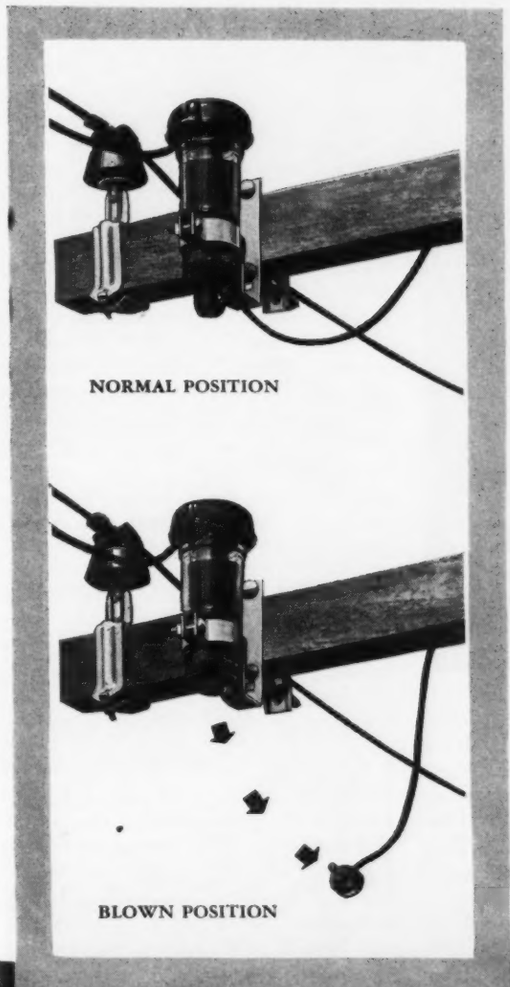
## TECHNICAL LITERATURE

SHIPBOARD INSTALLATIONS — "Electrical Installations on Shipboard" is a recommended practice published by the American Institute of Electrical Engineers, 33 West 39th St., New York City, at $1.50 a copy. The 98 pages of the booklet include definitions, direct-current equipment and installation, alternating-current equipment and installation, propulsion equipment and many tables for installations on shipboard.

DISTRIBUTION—"Ways to Save with Load-Center Distribution of Electric Power" is the subject of GEA-3377, eight-page leaflet of the General Electric Co., Schenectady, N. Y. Engineering and economic advantages of locating distribution transformers near the point of use of energy are pointed out. Typical installations are illustrated.

# You knew a phase was grounded—

# *but where?*




## . . . . . after hours of hunting you found a damaged lightning arrester

Modern Lightning Arresters are built to "take it", but any lightning arrester may become damaged in service at some time during performance of its duty. If it does, you would like to be sure that the damaged arrester cannot lock out a feeder. You would also like to be able to locate the casualty easily, quickly, for replacement.

All L-M Lightning Arresters — and only L-M Arresters — come equipped with the ISOLATOR, the circuit-clearing device that will automatically disconnect the arrester should it become damaged, and will indicate at the same time, visible from a distance, that the arrester has to be replaced.

In brief, with the L-M ISOLATOR you never have to hunt for an arrester that causes trouble, you never have to climb a pole to locate it.

Your L-M representative will be glad to explain the working of the ISOLATOR. Or request the L-M Bulletin No. 40151 which gives detailed information on all L-M Arrester features and the reasons why more and more distribution lines are protected by L-M Lightning Arresters.

**LINE MATERIAL COMPANY · MILWAUKEE, WIS.**

# NEWS ABOUT PEOPLE

## Hogue Elected President of Lighting Institute

Oliver R. Hogue, manager of lighting and wiring sales for the Commonwealth Edison Co., Chicago, was recently elected president of the Chicago Lighting Institute. Mr. Hogue, a former director of the Illuminating Engineering Society, has served the Chicago Lighting Institute as secretary-treasurer since its establishment in 1930 and has also been chairman of the committee on management. Other officers elected include: Secretary-treasurer, Ralph G. Raymond, who has just been appointed assistant to manager lighting and wiring sales, Commonwealth Edison Co., and assistant secretary-treasurer, G. K. Hardacre, general supervisor lighting sales, Public Service Co. of Northern Illinois. John G. Learned, vice-president Public Service Co. of Northern Illinois, continues as vice-president of the institute.

•

▶ ADOLPH BUSS, engineer for the Clintonville district of the Wisconsin Power & Light Co. for the past four years, has been named manager of the district, succeeding the late Walter B. Huebner.

▶ ANKER WINTHER has been made assistant general sales manager of the York Ice Machinery Corp., York, Pa. A native of Brooklyn, N. Y., and a graduate of Stevens Institute of Technology, Mr. Winther entered the York student course in 1928. Since 1930 he has been connected with the Cincinnati office as a sales engineer and during this period has worked on important industrial refrigeration and air-conditioning projects. He has sold and engineered a number of large-scale air-conditioning installations. He has conducted an air-conditioning lecture and problem course in the evening school of the University of Cincinnati and has written many articles on the subject of air conditioning for the trade magazines. He is a member of the American Society of Heating and Ventilating Engineers and was recently president of the Cincinnati Air Conditioning Association.

•

## John M. Orr Joins Staff of Philadelphia Co.

John M. Orr, formerly general manager of the Equitable Auto Co., has been appointed to the position of assistant to the president of the Philadelphia Company.

After graduating from Carnegie Institute of Technology in 1915, Mr. Orr entered the service of the Duquesne Light Co. as a clerk, and was later a lighting and small power salesman. In 1926 he become assistant to the vice-president and general manager. Two years later he was made general manager of the Equitable Auto Co.

Stuart G. Page has been appointed general superintendent of the Equitable Auto Co., succeeding Mr. Orr. After graduation from Iowa State College in 1924, Mr. Page entered the service of the Duquesne Light Co. as an apprentice engineer. He later became superintendent of plans and schedules, substations department, and in 1933 was appointed technical assistant to the vice-president in charge of operations.

Charles K. Krause has been appointed to the position vacated by Mr. Page as technical assistant to the vice-president in charge of operations, Duquesne Light Co.

•

▶ L. E. PRICE is the new superintendent of the power and light department of Columbus, Miss., succeeding J. L. Street, who resigned to join the Mississippi Power Co. as division superintendent at Meridian. Mr. Price was formerly connected with that utility.

▶ HAROLD J. MCCORMICK has been appointed manager of the advertising and public relations department of the Indiana Service Corp., Fort Wayne, to succeed Arthur M. Paulison, resigned. Mr. McCormick has been assistant secretary of the Fort Wayne Chamber of Commerce for four years. He was engaged in newspaper work prior to affiliating with the chamber. Mr. Paulison has become affiliated with an art glass company in Fort Wayne.

▶ GEORGE S. RENTSCHLER, chairman of the National City Bank, has been elected a trustee of the Consolidated Edison Co., Inc., New York, and a member of its executive committee. He succeeds the late James H. Perkins.

▶ A. J. NYDICK has been appointed executive secretary of the American Council of Commercial Laboratories, Hoboken, N. J. The council, which was organized in 1937, is made up of testing and research laboratories located throughout the country. The council was formed by the laboratories to serve as a clearing house to its various members and to serve as a control board in the maintenance of high standard professional ethics in the fields of testing and research. Mr. Nydick is associated

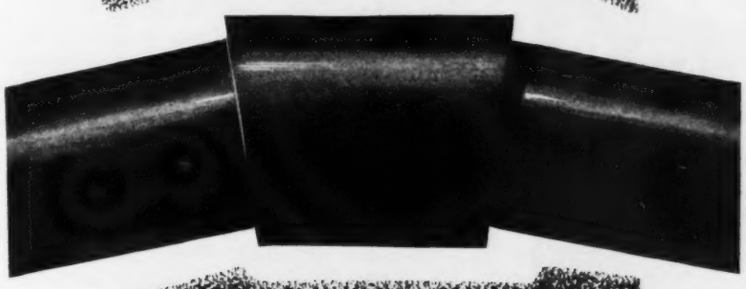
# ORANGEBURG OFFERS

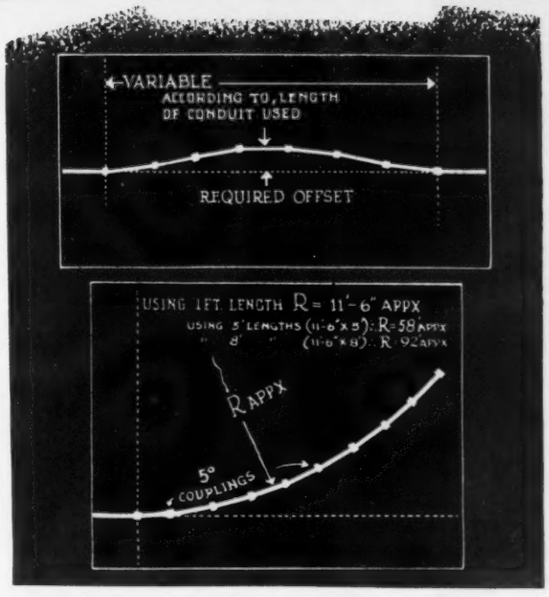
# *New*

# SAVINGS

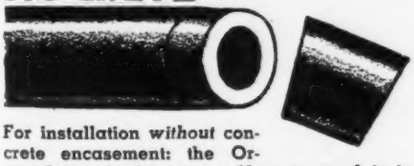
# WITH 5°

# ANGLE COUPLINGS






**NOCRETE**



For installation *without* concrete encasement: the Orangeburg dual-economy Nocrete conduit is recommended for service entrances, extensions, parkways and street lighting, suburban distribution, laterals, signal systems, etc.

**STANDARD**

For installation underground *with* concrete encasement: Orangeburg Standard Fibre conduit is recommended for duct banks (4 ducts and over), main distribution, high tension and "downstream" locations.

The dual savings in material and installation costs that have made both Orangeburg Standard and Orangeburg Nocrete preferred by practical buyers are now supplemented by a new saving created by Orangeburg.

For now you can avoid obstacles, make bends, swings and offsets of varying size in the field, on the job—at a fraction of the cost of special bends or ells—with the new Orangeburg 5° Angle Coupling.

And—like all other Orangeburg Couplings, this new fitting needs no jointing compound! Simply place the coupling on the tapered end of a section of Orangeburg, tap firmly with a mallet—and the accurately-machined Orangeburg Tapered Joint is water tight.

In terms of cable protection, this means that ground moistures, whether acid or alkaline, cannot penetrate the walls or joints and corrode the cable sheath. In terms of service, with all of its advantages Orangeburg's ultimate cost is still less than that of *any* other conduit manufactured.

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General Electric Supply Corp.

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**ORANGEBURG** NOCRETE for installation without concrete encasement
STANDARD for installation with concrete encasement

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FURNACE
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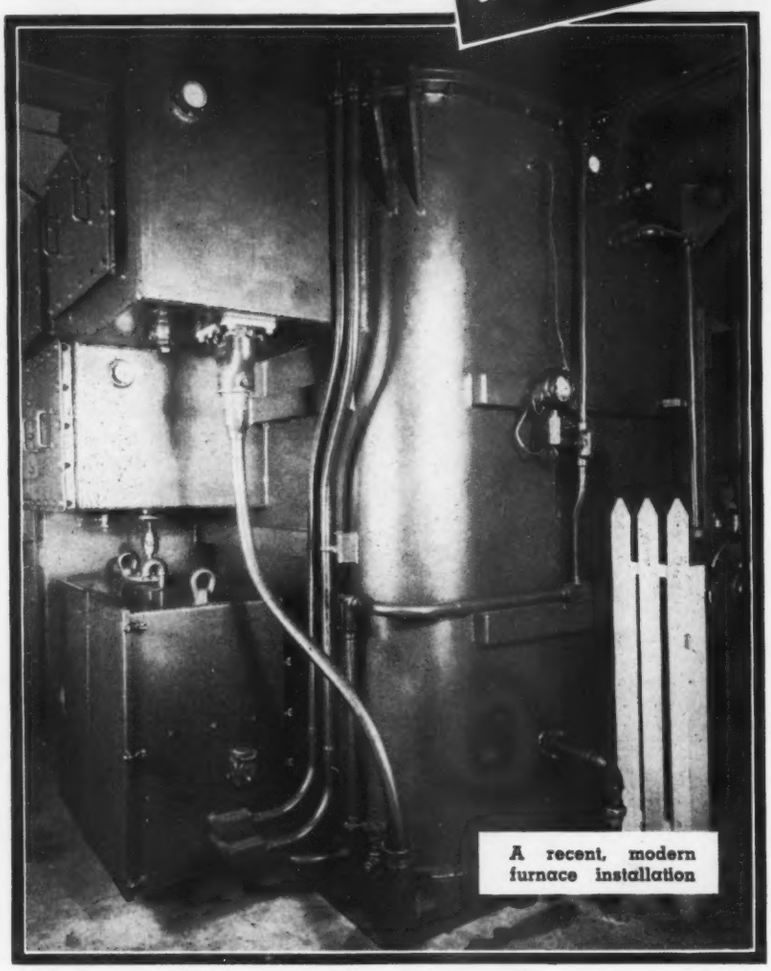

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with Garey & Garey, Esqs., New York. He is representative in Pennsylvania for the American Chemical Society and serves as general counsel for the Pennsylvania Chemical Society.

▶ HARRY V. RYDER has been appointed special assistant to the manager, industrial sales, Philadelphia division, Philadelphia Electric Co. He was formerly director, industrial and retail service, industrial sales department. Mr. Ryder is a native of New York City and a graduate engineer of the University of Pennsylvania.

▶ I. D. STURGES of Portland, Ore., was elected president of the northwestern section of the International Association of Electrical Inspectors at that society's recent annual meeting at Great Falls, Mont. Mr. Sturges succeeds Blaine Grey, chief electrical inspector for Salt Lake City, who was elected to the executive committee.

▶ HOYT P. STEELE has been elected vice-president of the Benjamin Electric Manufacturing Co. in charge of research and engineering, with headquarters at the general offices at Des Plaines, Ill. Mr. Steele specialized in marine engineering at the Massachusetts Institute of Technology, from which he was graduated in 1934. Immediately after graduation he entered the employ of the Bethlehem Shipbuilding Corp., Ltd., at Quincy, Mass., a subsidiary of the Bethlehem Steel Corp. Subsequently he joined the staff of Benjamin Electric Manufacturing Co. at its general works in Des Plaines, where, as an apprentice, he received training, later being transferred to the New York office as assistant manager of the Eastern sales division of the company.

▶ J. F. O'DONNELL, assistant sales manager of the Westinghouse merchandising division, has been appointed to direct the division's Pacific Coast sales operations. C. A. Meier, formerly Pacific Coast district manager, becomes manager of utility sales in that district and will continue to maintain his headquarters in San Francisco. A native of Washington, D. C., and a graduate of the Catholic University of America Mr. O'Donnell was connected for several years with Westinghouse distributors in Washington, D. C., and Rochester, N. Y., during which time he took a six-month leave to take the Westinghouse student course at East Pittsburgh. After service in the World War he was associated with the American Relief Commission in Poland and Rumania and was decorated for his services by the Rumanian Government. On returning to the United States he attended the Harvard University Graduate School of Business Administration. He returned to Westinghouse in 1921 and advanced in

# What material?

## C-D Manufacturing Experience and Laboratory Research will help you find the answer!

To every manufacturer facing a new manufacturing problem, or an unsolved old one, the C-D Laboratory's years of experience in solving difficult insulating problems is immediately available. Here is a research department you can treat as your own. Here are a group of men who for many years have been building records of material performance that today will prove invaluable in assisting you to find the appropriate insulating material for your problem.

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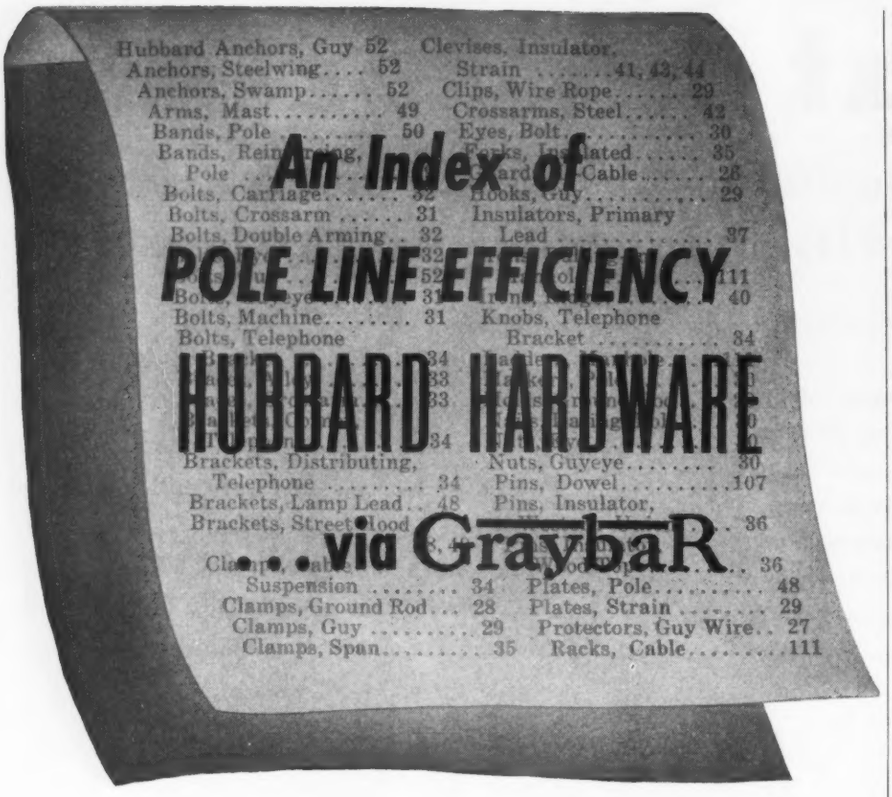
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HUBBARD HARDWARE
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When you check your needs under the name "Hubbard" in the GRAYBAR catalog, you're assuring yourself of efficient pole-line hardware performance from A to Z...from pole top pins to ground rods.

And whether it's standard guy clamps or cross-arm bolts you need, or an odd-sized street hood bracket, you are doubly assured of good value when you send the order "via GRAYBAR." You get prompt service, competent buying assistance, and exact conformity with the specifications of your order *plus* the satisfaction-insurance of the GRAYBAR tag.

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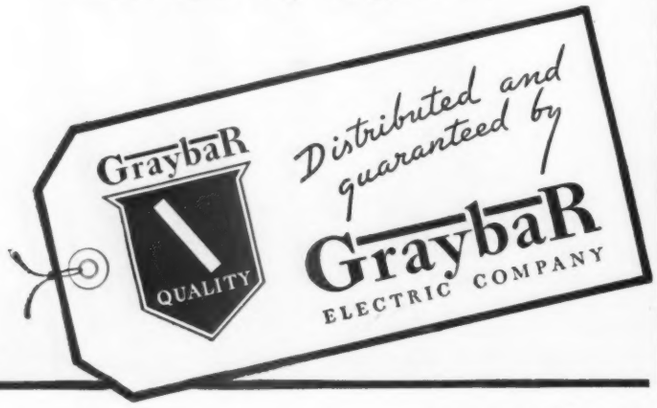



the sales executive ranks. He was appointed assistant sales manager in 1938 and will retain this position in his new assignment.

► GEORGE D. KINGSLAND has been appointed vice-president in charge of sales for the Eastern division of the Perfex Corp., Milwaukee, Wis. Mr. Kingsland will be located in the corporation's New York office. During his twenty years' association with the control industry he has pioneered many new ideas on controls and control systems. Mr. Kingsland is a member of the American Society of Heating and Ventilating Engineers and has been prominent in the society's activities on controls and control systems. He has also been identified with similar activities in the National Warm Air Heating and Air Conditioning Association and National District Heating Association.

## OBITUARY

### William W. Erwin

William W. Erwin, vice-president of Consolidated Edison Co. of New York, Inc., in charge of purchasing and stores,

died September 12 at his home in New York, after a long illness. He had been with Consolidated Edison and predecessor companies since 1900.

Mr. Erwin was born in Albany, N. Y., in 1878. Entering the employ of the New York Edison Co. as a draughtsman, he later became superintendent of construction and subsequently was made chief operating engineer of the company. In 1925 Mr. Erwin was elected controller of the New York Edison Co. and also of the Yonkers Electric Light & Power Co. Seven years later he was named vice-president of the New York Edison Co. and the United Electric Light & Power Co.

In 1936 he became vice-president of

# Facts You Can Use to Cut Distribution Costs . . . No. 3

## TRANSITE DUCTS RESIST CORROSION!

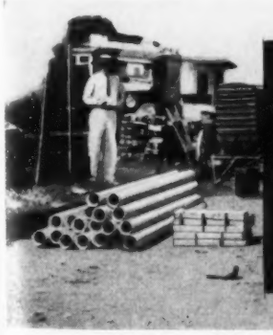
MAINTENANCE costs stay permanently low when Transite Ducts are used. Entirely inorganic and non-metallic, these asbestos-cement cableways are highly resistant to all forms of corrosion. They can't rust or rot . . . are virtually unaffected by fire.

Yet low maintenance is only part of the savings made by using Transite Ducts. Supplied in long, light lengths, these durable ducts are installed quickly and easily; thus, installation costs are kept low. For complete details on these money-saving ducts, write for Brochure DS-410. Johns-Manville, 22 East 40th Street, New York, N. Y.

**HIGHLY CORROSION-RESISTANT,** rustproof and rotproof, Johns-Manville Transite Ducts provide maximum assurance of long, efficient life and low maintenance when installed on exposed locations. On many bridge installations, such as the one shown above, Transite Conduit outperforms more expensive materials commonly used for the purpose.

**UNUSUALLY WEATHER-RESISTANT,** these asbestos-cement ducts may be safely stored outdoors. Their sustained strength permits piling to convenient heights without distorting or crushing the duct.

**UNIFORMLY STRONG AND DURABLE,** J-M Transite Conduit needs no protective casing underground. And its tough asbestos-cement composition offers superior protection against corrosive soils.



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**TRANSITE KORDUCT . . .** For installation in concrete. Thinner walled, lower priced, but otherwise identical with Transite Conduit.

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## ...client sells him bill of goods!

It's an honest-to-goodness situation. *Our own salesmen are being sold!*

*Ideas* are what they're falling for . . . ideas about the uses of their own product.

We have felt for a long time that LUX carbon dioxide fire extinguishers had something special to offer for protection of public utility properties. For LUX gets electrical fires out in a hurry . . . so fast that it confines fire to the point of rupture. LUX is clean, dry . . . eliminates mess and clean-up.

And now something is happening to our salesmen. You engineers are button-holing these men of ours and telling them *your ideas* about the use of LUX . . . design of LUX. What is more, they're excellent ideas. Our development engineers are using many of them, will use more.

We like your suggestions. Keep them coming.—And remember that, thanks to you, LUX protection is your best protection against crippling fires.

LUX SNUFFS OUT FIRE

**Walter Kidde & Company**

**Incorporated**

**928 West Street Bloomfield, N. J.**


Consolidated Edison Co., following the merger of gas and electric companies into the organization of that name.

•

▶ J. Otis Wardwell, 84, for many years counsel for public utilities in Massachusetts in association with the late Everett W. Burdett of Boston, died at his home in Haverhill, Mass., on September 10. He was born in Lowell, Mass.

▶ Chester A. Blamey, superintendent of distribution and transmission for the Citizens Electric Co., Hot Springs, Ark., died September 6, in his fifty-eighth year. Mr. Blamey had been with the company since 1908.

▶ Maurice L. Galvin, a director and for many years a legal counsel for the Union Light, Heat & Power Co., Cincinnati, died August 25, following a cerebral hemorrhage. He had been in ill health for more than a year. Mr. Galvin was 68 years of age.

▶ Philip M. Patterson, an electrical engineer at Boston, Mass., and graduate of the Lawrence Scientfic School of Harvard University, died at his home in West Roxbury on September 2. He represented in New England the Baldor Electric Co., St. Louis; Torrington Manufacturing Co., Torrington, Conn.; Ohio Electric Co., Cleveland; Detroit Stamping Co., Detroit; Electric Motor Corp., Racine, Wis., and other manufacturers at the time of his death.

▶ Stephen J. Garahan, manager of sales for the wire and cable section of General Electric Co.'s central station department, died at Schenectady's Ellis Hospital September 5. He was 53 years old. Mr. Garahan entered the service of the General Electric Co. in 1904 in the shipping department of the Schenectady Works. He was transferred to the wire and cable department in 1909, and became assistant to the head of the cable division in 1923. In 1929 he was placed in charge of cable quotations and later was made assistant manager of cable sales. He was appointed manager of cable sales in 1936.

▶ Edward W. Smith, manager of the development and design department of the Electric Storage Battery Co., died August 26 at his home in Germantown, Pa., after a year's illness. Mr. Smith was 65 years old. He was a graduate of the University of Pennsylvania.

▶ N. G. Wallace, formerly Oregon public utilities commissioner, died in Bend, Ore., August 8, after a long illness. He was 65 years of age. Born in Grant County, Ark., in 1875, Mr. Wallace was admitted to the bar in 1901. He moved to central Oregon in 1913. He served as public utilities commissioner from 1937 until he resigned in 1939.

# "You'll Find the latest Answers Here"

- . . . names of the administrative, managing and operating officials listed by title for each of the companies
- . . . information on holding companies, with cross-reference explaining the relationship with the operating company
- . . . the communities served by a given company
- . . . the name of the operating company or companies serving a given community
- . . . the number of meters connected
- . . . ratings and types of units in generating plants
- . . . type of distribution system and principal distribution voltage
- . . . inter-company energy purchases

**Altogether, the book is a veritable encyclopedia** on Central Station practice — invaluable as a sales aid and engineering reference for manufacturers and distributors selling to this field, for consulting and power-sales engineers, public service commissions, financial houses. For the central stations themselves, it is an up-to-the-minute roster of the men in other plants whom they are anxious to keep in touch with for personal or business reasons.

**This Latest Edition** is a complete directory, classifying geographically all operating and holding companies in North America and U. S. possessions; also all plants, both privately and municipally owned. It contains an alphabetical index to all companies listed—over 4,000 of them. Listings include names and titles of all responsible officials: full data on power generation, transmission, distribution, number of meters, etc.

**800 pages, strongly bound in flexible blue Fabrikoid; thumb indexed; size 4½ inches by 8½ inches. Published annually. Price $25.00 per copy. 10% discount on 5 or more copies.**

## VITAL, BASIC DATA TO HELP YOU PLAN

*Plant Equipment and Operating Data*—The Central Station Directory lists for every plant its total generating capacity; the types and capacities of all prime movers and generating units; the voltages, phases, cycles and wiring of the distribution system; total number of meters connected, etc.

*Personnel Data*—The Directory lists all administrative, managing and operating officials by name and title.

*Company Interlock*—Full holding company data are given, with cross-reference explaining the relationship.

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# MANUFACTURING - MARKETS

## Westinghouse Hits New Peak in Orders

Expanding peacetime and preparedness activity is mirrored in the report of Westinghouse Electric & Manufacturing Co., which President George H. Bucher said was the "biggest month in the history" of the company. Orders for the month totaled $57,352,054 and employment approached the peak months of 1929 and 1937.

August business was 68.8 per cent over July and business so far this year is up 67.1 per cent over the same 1939 period. Mr. Bucher said that a large part of August's business was taken at a very moderate profit, since some $36,000,000 of it represents emergency orders for the government's preparedness program.

"Though Westinghouse is primarily in the business of manufacturing peacetime products and must continue to maintain its normal production in this field," Mr. Bucher added, "we must do our part in this emergency. We are expanding our facilities to handle preparedness orders."

Mr. Bucher said that if all emergency orders were eliminated from the August report the remaining peacetime business—more than $20,000,000 worth—would still be comparable to the best peacetime months in the company's history. Even in the boom year of 1929 Westinghouse orders for a single month did not exceed $25,000,000.

Orders received during the first eight months this year totaled $226,513,813, against $135,542,968 in the same 1939 period.

"This advance in our business," Mr. Bucher said, "reflects generally improved business activity among our industrial, public utility and merchandising customers."

He reported that more than 52,300 persons were employed at the beginning of August, an increase of about 9,000 over the same month last year.

Largest single classification in August preparedness orders included about $21,000,000 for propulsion turbines and gears, switchboards and auxiliary equipment for marine service. Another $11,000,000 is for gun equipment for the Navy. About $4,000,000 represents government radio equipment orders.

•

## Burbank Awards Contract

Public Service Department, Burbank, Calif., has awarded a contract to the General Electric Co. at $13,045 for a ten-unit indoor-type, metal-clad switchgear assembly, for installation in the municipal power station; also for an inspection rack (Specifications 215).

•

## Gets Award for New Unit

City officials of Geneseo, Ill., have awarded the contract for a new generating unit for the municipal light and power plant to Fairbanks, Morse & Co., Chicago, at $22,492. Warren & Van Praag, Decatur, Ill., are the consulting engineers for the city.

## Electrical Orders Decreased in July

After the highest June since the beginning of 1934 of the index record of orders for transmission and distribution equipment and for motors and generators as kept by the National Electrical Manufacturers Association, a considerable drop becomes apparent in the indices for July.

For July the index for orders for transmission and distribution equipment stands at 170.2, a decrease from June of 11.7. For motors and generators the decrease is 5.9, a drop to 155.0 from 160.9 in June.

Except in 1935, when the index rose 12.1 points, the change from June to July in the previous six-year record of the index as regards motors and generators has been negative, averaging 21.6 points as the midsummer drop. This year the decrease is only one-sixth of the average.

The record shows no seasonal change in orders for transmission and distribution equipment easily and conveniently to explain the June-July drop in the

**NEMA INDEX, value of orders received for motors (large d.c., polyphase, synchronous) and generators (engine, belt-driven); also for transmission and distribution equipment**

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**Low Cost**
Perfectly Balanced

**Bakelite Enclosed Core**
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index for this class of orders. The previous six-year record shows three increases and three decreases from June to July. Last year these orders showed an increase of 17.9 points for July over June.

However, the elapsed seven-month record for 1940 shows comfortable margins of increase in orders for both classes of products in spite of the July decrease this year. For motors and generators the index averages 42.3 points higher for the seven months of 1940 over the same period in 1939. On the same basis of comparison orders for transmission and distribution equipment average 38.2 points higher this year.

•

## Extend Plant Facilities to Make War Supplies

Contract for construction of major extensions to the Peterborough, Ont., plant of the Canadian General Electric Co., at an estimated cost of $1,000,000, has been awarded to A. W. Robertson, Ltd., Toronto.

Subcontract for steel on the project, work on which is starting immediately, has been given to the Dominion Bridge Co. Primary purpose of the addition is to provide extra plant facilities for the production of war equipment and supplies.

•

## Furnas Electric Expands

Furnas Electric Co., West Allis, Wis., manufacturer of electric controls for motors and other electrical equipment, has approved plans for a new plant at Van Nortwick Avenue and McKee Street, Batavia, Ill., consisting of a main one-story unit, 50 x 300 ft., reported to cost more than $75,000. Ross Buck, North View Avenue, Aurora, Ill., is architect.

•

## Control Equipment Award

Lower Colorado River Authority, Austin, Tex., has awarded a contract to Leeds & Northrup Co., Philadelphia, Pa., for furnishing system automatic frequency control equipment for Lower Colorado River project.

### New York Metal Prices

| | Sept. 17, '40 Cents per Pound | Sept. 11, '40 Cents per Pound |
|---|---|---|
| Copper, electrolytic | 11.375* | 11.50* |
| Lead, A. S. & R, price | 4.90 | 4.90 |
| Antimony | 14.00 | 14.00 |
| Nickel, Ingot | 35.00 | 35.00 |
| Zinc, Spot | 7.24 | 7.24 |
| Tin, Straits | 50.05 | 50.125 |
| Aluminum, 99 per cent | 18.00 | 18.00 |

*Delivered Connecticut Valley.

# Field Reports on Business

*Mid-September finds volume of production sweeping forward in an increasing number of fields and higher levels can be expected due to the present heavy totals of forward ordering. Sharpest rises are occurring in the electrical machinery group, as typified by the current Westinghouse August report.*

## NEW YORK

Many straws show this week that a strong business wind is blowing across the nation's industries in the form of commitments and forward orders.

Total freight traffic over steam railroads is making a better-than-seasonal showing this month. Miscellaneous carloadings covering manufactured and semi-manufactured goods have reached a new high since last September.

Steel, of course, is being produced at a high rate, a new high for the year and practically at capacity with present indications that 1940 production will surpass that of 1929.

Defense orders are not yet preponderant in the steel market, but buyers generally are already beginning to feel the effect in quotations covering longer deliveries.

Unfilled orders on hand in the durable goods industries marked up a 13 per cent gain in the latest report (July) of the Department of Commerce. This was the largest increase in any single month this year and represents the third successive upswing in this backlog in the face of expanding production and unfilled orders are now above the total of last September's "war scare" peak.

Along these lines the Westinghouse report for August offers concrete evidence of the possible impact of the defense program on American industry. Previously the best month in Westinghouse history was October, 1917, with $50,000,000 of new business booked. In August, 1940, a new high of $57,352,054 was booked. Government orders in August were for $36,000,000 of gun equipment, radio equipment, warship machinery, etc.

Orders from other than government origin were $20,000,000, on a par with 1929 totals. The demand for new appliances is impressive and probably reflects consumers' fears of another H.C.L. period.

## PACIFIC COAST

Shipbuilding is now the predominant industry along the coast, with its high proportion of varied electrical needs and skilled worker wages. These ships are 100 per cent electrically welded and recent welding apparatus orders include $35,000 for Bethlehem and $11,000 for small outfits for various other industries.

Other industrial business covers $25,000 fractional-horsepower motors for stock pumping outfits, $35,000 for three 1,000-hp. dynamometers, $20,000 turbine parts for a sugar refinery, a 1,000-kva. synchronous converter and accessories, value $65,000, for a Honolulu rapid transit system, an $8,000 switchboard for a salt refinery and $90,000 dredger equipment ordered for a Colorado location. Coast subcontractors have protested to Washington over the policy of a fixed fee award to a general contractor, as in the instance of Alameda Air Base award of $9,450,000 plus 6 per cent fee.

Electrical machinery business has apparently reached a peak in the $700,000 award to General Electric for an 82,500-kva. generator for Boulder Dam plant and a $1,013,020 contract to Westinghouse covering a 65,000-kva. steam-generator unit and equipment for standby service at Los Angeles harbor for Bureau of Power and Light. Pacific Gas & Electric purchases include four 5,000-kva. outdoor transformers, value $90,000; 80 capacitors, 15 kva. rating, value $8,500; four 500-kva. network transformers, value $20,000, and a $12,000 protector network.

## NEW ENGLAND

Plans for the expansion of power generation facilities and the extension of service to meet the demands of industries and shipyards in this area are rapidly taking form among a number of prominent utilities located in this district. In addition to the large machinery and supplies commitments now being studied by manufacturers here, the announcement of further awards on a large scale involving great volumes of wiring supplies for power and light are spurring on activity.

Cloth contracts booked in this district are running into considerable volume and size and should presage further buying of electrical supplies by textiles. Small motor sales are steady, with machine tool builders regularly duplicating their orders. Inquiries for transformers are increasing; line material sales are featuring stronger tendencies in buying poles and hardware.

Hygrade-Sylvania Corp. plans to market a 100-watt fluorescent lamp during the coming fall. Lighting installations in the downtown Boston area include modernization in a well-known drug store chain and the installation of auditorium and stage lighting effects in the new Old South Theatre, now under construction. Prospects for closing the year with an all-time record of major appliance sales in this district is reported from several distributors who point to the completion of an unusually large amount of domestic housing and the probability that new areas adjacent to the most active centers effected by government awards will witness an uninterrupted building program throughout the remainder of 1940.

## CHICAGO

Preparations are being made for rather extensive expansion of industrial facilities throughout the Middle West. The awarding of defense contracts involving large sums combined with normal seasonal trends is providing additional stimulus to the already excellent prospects. Inquiries for electrical equipment have increased sharply to meet the requirements for additional manufacturing machinery and space.

Large defense orders were awarded last week to firms in this area. Installation of a new $734,000 lighting system for runways has been started at the Municipal Airport. Manufacturers report heavy demand for electric motors and control equipment for industrial uses. Wire and cable, transformers and switching apparatus are moving exceptionally well.

Utility purchases continue at high level and electric appliance sales are climbing steadily as retail trade moves sharply upward.

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- All clamping and fastening bolts are through bolts.
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*Not supplied on single pole units.

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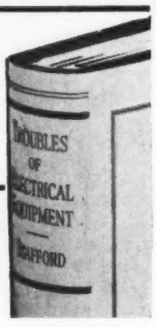


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## Recent Rate Changes

PUBLIC SERVICE CO. OF OKLAHOMA has filed a new schedule of rates, reducing electric charges from 8.6 per cent to 11.3 per cent for residential and commercial consumers in 126 eastern Oklahoma cities. The state Corporation Commission has approved the new schedule. Reford Bond, chairman of the commission, declared the new rates will make possible a saving of approximately $315,000 annually to consumers in the 129 cities. Rates had previously been reduced in Okemah, Vinita and Nowata and these reductions went into effect September 1. The more recent reductions will become effective October 1. In a statement issued by the corporation commission it was said that reductions were the result of studies made over a long period of time by engineers of the Public Service Company and the commission. The commission denied that the building of the Grand River Dam had had anything to do with this recent reduction. "In the nine-year period immediately preceding announcement of funds for the Grand River Dam, reductions were made by the company which now amount to more than $925,000 a year," the statement said. "These facts are in direct contradiction to published statements of Grand River Dam Authority officials which appeared recently, wherein it was inferred that the rate reductions ordered by the commission were brought about through the building of the Grand River Dam." The statement further declared that the reduction ordered recently together with reductions made for the last 12 years in cities served by the company add up to a saving of more than $1,300,000 annually to consumers.

SEATTLE CITY LIGHT will make reductions in commercial light and power rates that will save customers $251,000 a year on October 1, as a result of action taken by the City Council when at a special meeting it recommended passage of the rate reduction ordinance. Light superintendent E. R. Hoffman said the cut meets the reductions made recently by the Puget Sound Power & Light Co. He said the $251,000 saving to customers will bring total City Light reductions since last fall to $600,000. The new scale will affect virtually all commercial light and power customers. Two changes were made in commercial lighting rates. For the first 100 kilowatt-hours a month, per kilowatt-hour of maximum demand, the new price is 3½ cents per kilowatt-hour, 1 cent lower than the old rate. An optional rate is 3½ cents per kilowatt-hour for the first 400 kw.-hr. used. Previously, the optional rate had been 4 cents per kilowatt-hour for the first 200 kw.-hr. and 3½ cents for the next 200 kw.-hr. One change was made in commercial-power rates. The rate was cut from 4 cents to 3½ cents per kilowatt-hour for the first 100 kw.-hr. per month. The special rate given the Port of Seattle for lighting was cut from 2 cents per kilowatt-hour to 1¾ cents.

NEW JERSEY PUBLIC UTILITY INFORMATION COMMITTEE has announced that rate reductions in the ten years ended with 1939 saved consumers of electricity in New Jersey more than $17,000,000. The statement is based on the statistics of four companies which generate annually more than 99 per cent of the energy produced in the state. The saving is really much greater because of the cumulative effect of each reduction from year to year, so that $17,000,000 may be said to be minimum, according to the report. Public Service

Electric & Gas Co. in the past ten years reduced rates ten times, the successive reductions totaling $12,900,000. Atlantic City Electric Co. made thirteen rate cuts amounting to $2,025,000; Jersey Central Power & Light Co. made 24 electric rate reductions amounting to $1,222,993; and the New Jersey Power & Light Co. made seventeen rate cuts totaling $1,044,734.

NEWPORT ELECTRIC CORP. will reduce its rates $29,919 annually, according to an announcement made by Public Utilities Administrator B. M. McLyman of Rhode Island. Residential rates will drop by $17,432 and affect 9,257 customers; 270 power customers will save $1,987 yearly, and the so-called power-lighting-short-term rate will fall by $4,500. The general service primary power rate reduction of the company has been effective since July 1 and saves about $6,000 annually. The reductions comprise the second step in a three-step plan recommended several years ago as as a result of a general rate survey in the state, in which $774,000 reduction will have gone into effect on the Narragansett Electric system, $217,850 on the Blackstone Valley system and $95,000 on the Newport system, or a total of $1,107,964 by October 1, 1940. Commissioner McLyman is now studying data bearing upon the third step in the rate reduction program for the state. On account of the 1938 hurricane a year's postponement of the first reduction was granted.

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## Slattery Announces Rural Allotments

Allotments totaling $2.362.000 for rural electrification in various states were recently announced by Harry Slattery, Administratory of Rural Electrification. These allotments provide for the enlargement of 18 co-operatives and added generating facilities for two power systems. They were the first allotments made during the month of September and brought allotments made by REA since it was established in 1935 to $312.267,114. Details of the allotments follow:

DELAWARE — Delaware Rural Electric Assn., Greenwood, A. G. Ingram, supt., $100,000 to build 125 miles of line, 390 members in Kent and Sussex Counties.

FLORIDA — Clay Electric Co-operative Assn., Inc., Keystone Heights, Copeland S. James, supt., $45,000 for added generating facilities.

IOWA—Farmers' Electric Co-operative, Inc., Greenfield, Albert Ray, president, $174,000 to build 226 miles of line, 563 members in Madison, Adair and Cass Counties.

LOUISIANA—Northeast Louisiana Power Co-operative, Inc., Winnsboro, Robert E. Holladay, Jr., supt., $80,000 to build 122 miles of line, 354 members in Richland, Franklin, West Carroll and East Carroll Parishes.

MAINE—Farm-Home Electric Co-operative, Inc., Patten, James G. McLeod, supt., $104,000 to build 100 miles of line, 289 members in Aroostook County.

MINNESOTA—Stearns Co-operative Electric Assn., Melrose, George Halonen, Jr., supt., $208,000 to build 250 miles of line, 668 members in Stearns, Morrison, Todd,

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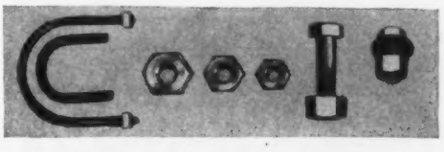

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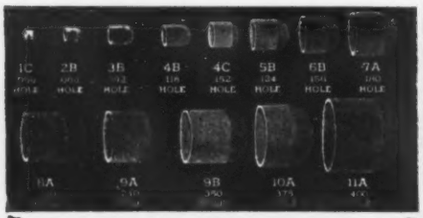


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Leading Utilities prefer COLORTOPS because the all-porcelain top (no shocks) — bottom venting (no burns) — double-wall construction — large center contact rivet — positive indicator when blown and Underwriters' label contribute enormously to the promotion of public safety. Performance characteristics also eliminate unnecessary blowings and loss of revenue.

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Pope and Kandiyohi Counties. Lake Region Co-operative Electrical Assn., Pelican Rapids, Albert R. Knutson, supt., $149,000 to build 195 miles of line, 399 members in Becker and Wilkin Counties.

NORTH CAROLINA—Union Electric Membership Corp., Monroe, H. W. Cunningham, supt., $158,000 to build 168 miles of line, 559 members in Cabarrus, Mecklenburg, Rowan, Stanly and Union Counties.

NORTH DAKOTA—Cass County Electric Co-operative, Inc., Kindred, A. J. Tuskind, mgr., $343,000 to build 518 miles of line, 979 members in Cass, Richland, Sargent, Barnes, Stutsman, Ransom and Dicky Counties.

OREGON—Benton-Lincoln Electric Co-operative, Inc., Corvallis, Guy Thomas, supt., $285,000 to build 260 miles of line, 778 members in Benton, Lincoln and Polk Counties.

SOUTH CAROLINA—Aiken Electric Co-operative, Inc., Aiken, T. W. Henderson, supt., $83,000 to build 108 miles of line, 354 members in Saluda, Edgefield, Aiken, Orangeburg and Lexington Counties. Fairfield Electric Co-operative, Inc., Winnsboro, E. V. Lewis, supt., $70,000 to build 75 miles of line, 292 members in Chester, Fairfield, Kershaw and Richland Counties. Edisto Electric Co-operative, Inc., Bamberg, D. L. Edwards, supt., $156,000 to build 190 miles of line, 617 members in Orangeburg, Dorchester and Bamberg Counties.

TENNESSEE—Southwest Tennessee Electric Membership Corp., Brownsville, E. H. Wright, supt., $51,000 to build 51 miles of line, 282 members in Madison, Tipton, Haywood, Fayette, Hardeman, Lauderdale, Crockett and Chester Counties.

UTAH—Moon Lake Electric Association, Inc., Mt. Emmons, E. D. Conklin, supt., $128,000 for added generating facilities.

WISCONSIN—Grant Electric Co-operative, Lancaster, Clyde G. Newcomb, supt., $59,000 to build 99 miles of line, 355 members in Grant County. Crawford Electric Co-operative, Gays Mills, C. H. Hooverson, supt., $61,000 to build 70 miles of line, 168 members in Crawford and Vernon Counties. Eau Claire Electric Co-operative, Eau Claire, F. R. McFarland, supt., $126,000 to build 141 miles of line, 324 members in Chippewa, Eau Claire, Jackson and Trempealeau Counties.

WYOMING — Riverton Valley Electric Assn., Riverton, L. S. Landmichl, supt., $86,000 to build 110 miles of line, 219 members in Fremont County.

Allotments made at the end of August included the following:

ARKANSAS—C and L Rural Electric Co-operative Corp., Star City, Lynn Thomasson, supt., $45,000 to build 62 miles of line, 172 members in Lincoln, Bradley, Jefferson, Cleveland and Grant Counties.

MISSOURI—White River Valley Electric Co-operative, Inc., Hollister, $35,000 to build 40 miles of line, 165 members in Taney, Christian, and Stone Counties and the Village of Gainsville.

PENNSYLVANIA — Valley Rural Electric Co-operative, Inc., Martinsburg, John Denton, supt., $25,000 to complete the project and to defray certain expenses connected with the initial operations of the system which cannot be covered by the construction loan.

BLUE RIDGE ELECTRIC ASSOCIATION, INC., Young Harris, Ga., was given an allotment of $402,000, of which $195,250 will be used to acquire lines now operated by the Tennessee Valley Authority and the remainder to build about 165 miles of line in Towns, Union and Fannin Counties, Ga., and Cherokee County, N. C.

## Sales Opportunities

CLAY CENTER, KAN.—City Council receives bids until October 9 for extensions and improvements in municipal power plant, including new turbine-generator, condenser, boiler and auxiliary equipment. Cost about $150,000. Burns & McDonnell Engineering Co., 107 West Linwood Boulevard, Kansas City, Mo., is consulting engineer.

FARMINGDALE, N. Y.—Republic Aviation Corp., Farmingdale, L. I., plans installation of motors and controls, switchgear, duct lines, transformers and accessories, industrial lighting facilities, conveyors, electric hoists and other equipment in new additions to aircraft-manufacturing plant, totaling close to 1,000,000 square feet of floor space. Proposed to begin work at once. Cost reported over $7,500,000.

DENVER, COLO.—Bureau of Reclamation, Denver, receives bids until October 11 for one 23,000-volt bus structure and one transformer neutral bus structure for generating unit A-5, Boulder power plant, Boulder Canyon project, Arizona-California-Nevada (Specifications 934). Also, until October 1, for air-conditioning and ventilation equipment for Parker hydroelectric power plant, Parker Dam project, Arizona-California (Specifications 1427-D). Equipment in both cases will be installed by Government.

UTICA, N. Y.—Savage Arms Corp., Utica, plans installation of transformers and accessories, switchgear, motors and controls, electric drives, industrial lighting equipment, duct lines, conveyors, electric hoists and other apparatus in group of existing one and multi-story buildings, idle for some time past, to be modernized and equipped for production of machine guns and cannons for War Department, for which company has secured large award. Cost estimated close to $17,600,000, and financing will be arranged with Federal Government in that sum. Completion of project is scheduled late in 1941.

BREMERTON, WASH.—Bureau of Supplies and Accounts, Navy Department, Washington, D. C., receives bids until September 27 for fifty 5-kw. capacitors, 220-volt, three-phase, for Puget Sound Navy Yard, Bremerton (Schedule 3108).

JACKSONVILLE, FLA.—Board of Public Utility Commissioners plans extensions in transmission line to site of new naval air station at Palatka, Fla., where service will be furnished from municipal power plant. Also terminal substation at latter place for distribution service. Cost estimated over $500,000. Proposed to begin work soon.

MILWAUKEE, WIS.—Wisconsin Electric Power Co. will proceed with construction of second-story addition to switching station at 219 West McKinley Avenue, 39 x 94 feet, for which building permit recently was secured. Additional equipment will be installed for increased capacity.

ST. MARYS, GA.—St. Marys Kraft Corp., St. Marys, care of Gilman Paper Co., Gilman, Vt., Charles Gilman, vice-president (recently chartered with capital of $1,000,000 by Mr. Gilman and associates, as an associated interest), plans installation of motors and controls, switchgear, conveyors, transformers and accessories, industrial lighting facilities, electric hoists, loaders, conveyors and other equipment in new kraft pulp mill on 80-acre tract of land near St. Marys, fronting on North River, where site has been selected. A power house is planned; also


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Transmission men need no crystal ball to foresee increased load demands in the *immediate* future. This calls for more cable joint work, prompt action all along the line.

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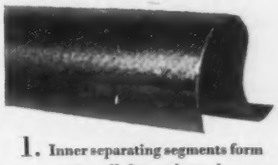
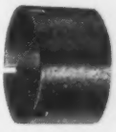
**Conducell is a *tested* joint *before* you put it in the ground!**



1. Inner separating segments form a separate cell for each conductor.



2. Spacing ring insures the same separation and amount of compound between each conductor.

3. Sections in position, ready for the outer tube to be drawn over.

## MICA INSULATOR COMPANY

MICANITE . . . EMPIRE VARNISHED INSULATIONS . . . LAMICOID LAMINATED PLASTIC MATERIALS

FROM P. A.
TO LINEMAN
it's
SEYMOUR SMITH
TOOLS
When the purchasing agent demands economy and quality — when the operator wants speed, efficiency and positive action, Seymour Smith pruning and clearing tools get the call. For only in Seymour Smith Tools can you get the full measure of satisfaction that has made them first choice of most leading utility companies.
• TREE and TELEPHONE PRUNERS
• POLE and HAND PRUNING SAWS
• LONG HANDLED PRUNERS AND BRUSH CUTTERS
• JOINTED TEST PIKE POLES
• CABLE CUTTERS
• RANGING RODS
WRITE FOR COMPLETE CATALOG
Seymour Smith & Son, Inc.
98 Main Street, Oakville, Conn.

DELTA-STAR
Bus & Cable Connectors
ASK FOR BULLETIN 38-D
TYPE "VTL"
Bus Bar Clamp Lugs
For combination bar and cable connections, with solder type lug for cable tap.
Clamps are of malleable iron and bronze, hot galvanized and bright dipped respectively. Cable lug is of high conductivity copper.
DELTA-STAR ELECTRIC CO.
2400 BLOCK CHICAGO, FULTON ST. ILLINOIS.


an electric-operated pumping station for water supply for mill service. Entire project is reported to cost over $1,500,000. Erection will be placed under way soon.

DEARBORN, MICH. — Ford Motor Co., Dearborn, plans installation of generator set, motors and controls, switchgear, duct lines, regulators, electric hoists, electric cranes, conveyors and other equipment in new local plant for production of aircraft engines, to comprise several large one-story structures for parts manufacture and assembling. Work will be placed under way soon, with plant completion scheduled early next spring. Cost is reported close to $10,000,000, of which approximately $7,000,000 will be expended for machinery and equipment.

WAKEFIELD, MICH.—City Council has plans maturing for a new municipal power plant. Estimates of cost are being made. Special election has been called October 8 to approve project.

MUNCIE, IND.—Indiana General Service Co., Muncie, has authorized extensions and improvements in primary and secondary lines in parts of Grant, Delaware, Blackford and Madison Counties, for expansion in rural electric system, including additions to main transmission system. Also will install a number of new power substations, with extensions in present power substations and installation of equipment. Company is arranging for early purchase of various equipment. Entire project estimated to cost about $2,000,000.

ALGONA, IOWA—City Council receives bids until October 1 for construction of new municipal power plant, including cooling towers, two 25,000-gallon oil storage tanks, and other facilities. Burns & McDonnell Engineering Co., 107 West Linwood Boulevard, Kansas City, Mo., is consulting engineer.

BUFFALO, N. Y.—Curtiss-Wright Corp., 30 Rockefeller Plaza, New York, N. Y., plans installation of transformers and accessories, motors and controls, duct lines, switchgear, industrial lighting equipment, regulators, electric hoists, electric cranes, conveyors and other equipment in proposed new airplane-manufacturing plant in vicinity of municipal airport, Buffalo, for production of large bomber aircraft for Federal Government. It will consist of group of one-story structures for parts manufacture and assembling, with cost reported close to $5,000,000.

•

## Market New Radio Line

To meet the demands of the market for de luxe radio equipment, General Electric radio and television department, Bridgeport, Conn., will shortly market such a special line of receivers.

•

## Contracts for New Unit

The village of Cashton, Wis., has entered into a contract with Fairbanks, Morse & Co., Chicago, for the installation of an additional Diesel engine generating unit at a cost of $16,828. The utility has a sufficient reserve fund to pay for this unit without cost to the taxpayers.

STRAIGHT to the MARK
Next time you buy relays or timers try Dunco! Let us prove the advantages of Dunco quality plus Dunco service in fitting units to your specific requirements. Don't guess on anything so important to the performance of your product. Get the facts! See how Dunco service speeds straight to the mark in assuring the utmost in electrical control dependability, plus honest economy of a type that is readily evident in the long run.
DUNCO RELAY BOOK gladly sent on request. Invaluable to relay users.
STRUTHERS DUNN, Inc.
1319 Cherry Street
Philadelphia, Penna.
DUNCO RELAYS
Made right - Priced right - Adapted to your needs

GAR WOOD
WINCHES
DERRICKS • CRANES
FOR PUBLIC UTILITY TRUCKS
Gar Wood offers the most complete and dependable Hoisting, Hauling and Handling Equipment for increasing productive truck hours.
CRANES for rapid handling of sewer, gas, water pipes, machinery and transformers.
There is a Gar Wood WINCH to fit the job— a type for every Utility requirement.
HYDRAULIC REPAIR TOWERS for street light and power line maintenance.
DERRICKS for pole setting. Four sizes for 35' to 65' poles.
Bulletin W140A sent on request. Advise character of work to be done.
GAR WOOD INDUSTRIES, Inc.
WINCH DIVISION
7925 Kinsdale Street
DETROIT • MICHIGAN

## Performance Justifies Air-Blast Breakers

[*Continued from page 51*]

and more rugged design. The main blast valves installed in 1934 have not needed any repairs or replacements.

In 1936, a fourth generating unit having been installed, two additional 138-kv. air-blast breakers were required and these were built by the English Electric Company of Canada, following the same general design of the 1934 breaker with improvements in detail. The disconnecting switch blade was made shorter and lighter, opening horizontally (instead of vertically), permitting faster operation. The blast valves were made with much lighter moving parts, which was mainly responsible for the reduction in opening time (from energizing of trip coil to interruption of current) from four to two cycles. The interrupter contacts are operated individually by pneumatic means.

In 1939 an additional line going into service required another 138-kv. breaker, which also was built by the English Electric Company and has been placed in service. This breaker follows the same general design as the 1936 breaker, again with certain improvements in detail. The interrupter contacts are of an improved design which has been developed by extensive interrupting tests during the past two years, including the interruption of currents of 46,000 amp. (85,000 amp. initial peak). The breaker has three moving contacts with six stationary contacts, making six breaks in series per pole.

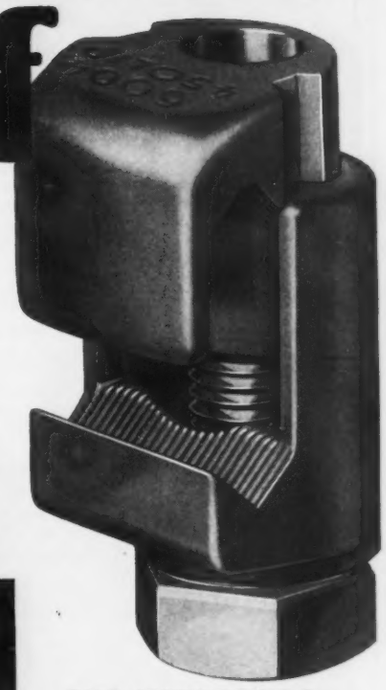
The station structure provides space for the addition of five 138-kv. air-blast breakers at some future date.

### *230-Kv. Breakers Designed*

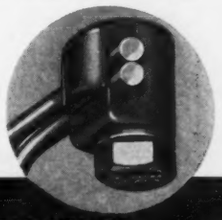
The design for air-blast breakers is easily extended to higher-voltage units. For example, a 230-kv. breaker of our design is the same as the 138-kv. breaker illustrated, except that the number of interrupting contracts in series, the number of insulators per stack and the phase spacing are doubled. The potential across the series contacts when open is equalized by a potentiometer of very high resistance.

Breakers of this design for 230 kv. can be tested up to the highest interrupting ratings, such as 2,500,000 kva., by interrupting 140,000 kva. single-phase across one pair of con-


vibration proof



Wind-whipped conductors don't shake loose inside Fargo "6000" Connectors. Fargo jaws are *self-locking* under compression, their grip is permanently slip-proof. That's why the new streamlined, vibration-proof Fargo "6000" eliminates radio interference troubles. Now available in No. 4 and No. 6 sizes. Other sizes at a later date.



MADE BY FARGO MFG. CO.
DISTRIBUTED BY
LINE MATERIAL CO.

THE NEW FARGO "6000" CONNECTOR

ROME-CABLE ROME, N.Y.

Hot Rolled Copper Rods • Bare and Tinned Strand
Bare and Tinned Copper Wire
(In Rounds, Flats and Squares)
URC Weatherproof Wire
Cotton, Paper and Asbestos Magnet Wire
(In Rounds, Flats and Squares)
Rubber Insulated Wires and Cords
Lead Covered Cables • Multiconductor Power Cables
Network, Service Entrance, Control Cables

ROME-60
ROME CABLE CORP. ROME, N.Y.
That New, Tough, 60% Jacketed, Heavy Duty Portable Cable

ROME CABLE
CORPORATION
ROME, N.Y.
SALES OFFICES:
New York Chicago Cleveland Pittsburgh Detroit
Boston Richmond Philadelphia Los Angeles

# PROFESSIONAL SERVICES

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Accounting
Valuations

Management
Appraisals
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Designing
Testing
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## WILLIAM A. BAEHR ORGANIZATION, INC.

ENGINEERS—ACCOUNTANTS—MANAGERS
231 South La Salle St.
CHICAGO

## E. T. L.

TESTS
*Electrical, Chemical, Mechanical, Photometric*
INSPECTIONS — Materials and Supplies
RESEARCH — Private Labs. for Clients
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ENGINEERS
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FINANCING—REORGANIZATION—DESIGN—CONSTRUCTION—
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INDUSTRIAL and PUBLIC UTILITIES
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Utility and Industrial Valuations, Design and Construction of Power Systems, Water Supplies, Sewerage and Sewage Disposal, Factory Production and Cost Control Systems.
11 Park Place, New York City
36 State Street, Albany, N. Y.

## FRANK F. FOWLE & CO.

Electrical and Mechanical
ENGINEERS
35 East Wacker Drive Chicago, Ill.

## SARGENT & LUNDY

Incorporated
ENGINEERS
140 South Dearborn St.
Chicago, Ill.

## BLACK & VEATCH

*Consulting Engineers*
Water, Steam and Electric Power Investigations, Design, Supervision of Construction, Valuation, Tests and Laboratory Service.
4706 Broadway, Kansas City, Mo.

## HOOSIER ENGINEERING COMPANY

Erecting Engineers
Transmission Lines, Substations
46 So. 5th St., Columbus, Ohio
431 So. Dearborn St., Chicago, Ill.
136 Liberty St., New York

## SPOONER & MERRILL, INC.

*Consulting Engineers*
Design—Supervision of Construction
Reports—Examinations—Valuations
20 North Wacker Drive, Chicago, Illinois

## CHENEY AND FOSTER

*Engineers and Consultants*
61 Broadway New York

## WILLIAM S. LEFFLER

succeeding
CHARLES F. LACOMBE—WILLIAM S. LEFFLER
*Engineers — Economists*
Public Utility Management Problems
Economic Audits for Selective Load Building
Balanced Domestic Load Development
Cost Analysis—Rate Cases
30 East 42nd Street—New York

## STEVENS & WOOD

Incorporated
ENGINEERS AND CONSTRUCTORS
30 Broad Street New York

## HUGH L. COOPER & CO.

General Hydraulic Engineering, including the design, financing, construction and management of hydro-electric power plants.
101 Park Ave. New York

## J. H. MANNING & COMPANY

ENGINEERING SERVICES
120 BROADWAY, NEW YORK
FIELD BUILDING, CHICAGO

## STONE & WEBSTER ENGINEERING CORPORATION

Design and Construction
Reports • Examinations • Appraisals
Consulting Engineering
BOSTON • NEW YORK • CHICAGO
PITTSBURGH • SAN FRANCISCO • LOS ANGELES

## DAY & ZIMMERMANN, INC.

ENGINEERS
Design - Construction - Management
Investigations and Reports
NEW YORK — PHILADELPHIA, Packard Building — CHICAGO

## DANIEL W. MEAD
## F. W. SCHEIDENHELM

Consulting Engineers
Hydro-Electric Development, Dams, Water Supply, Flood Control. Engineering Problems relating to Water Rights and Water Power Law. Appraisals.
New York City, 50 Church St.

## A. Y. TAYLOR AND COMPANY

*Municipal and Industrial Consulting Engineers*
Reports, Appraisals, Design
Supervision of Construction
2 So. Central Ave. Clayton, Mo.

## ROBERT E. FOLEY

*Erecting Engineer*
Rural Lines—Transmission Lines
Fire Alarms—Telephone Lines
48 Griswold St. Binghamton, N. Y.

## ARTHUR L. MULLERGREN

*Public Utilities Consultant*
*Management*
Fairfax Bldg. Kansas City, Mo.

## THE J. G. WHITE ENGINEERING CORPORATION

Engineers—Constructors
Steam and Hydraulic Power Plants
Transmission System—Substations
REPORTS AND APPRAISALS
80 Broad Street New York

## FORD, BACON & DAVIS, Inc.

*Engineers*
DESIGN • CONSTRUCTION
VALUATIONS • REPORTS • INTANGIBLES
New York — Philadelphia — Cleveland — Chicago

## Recording & Statistical Corp.

BILL ANALYSIS—CONSUMPTION STUDIES
THE ONE-STEP METHOD
*Bill Frequency Analyzer*
102 Maiden Lane New York

## READERS MAY CONTACT

the consultants whose cards appear on this page with the confidence justified by the offering of these special services nationally.

## $1 TO $2 A POLE BUYS 7 TO 10 YEARS MORE SERVICE LIFE!

Virginia Electric Power Co. has been using Osmoplastic Groundline Treatment since 1936.

SEVEN to 10 years more service life from standing poles at a cost of only $1 to $2 a pole, including labor! That's the bargain offered by OSMOPLASTIC GROUNDLINE TREATMENT . . . and that's why more than 50 leading utilities are now using it. OSMOPLASTIC requires no pressure- or heating equipment whatever; treatment is simple as A-B-C, yet its effectiveness is definitely proved by actual field records on many thousands of utility poles. Write or wire for full details.

**OSMOSE WOOD PRESERVING CO.**
of AMERICA, Inc.
General Offices, 1437 Bailey Ave., Buffalo, N. Y.

STRENGTH, ruggedness and durability are combined with definite economy in *Crapo* Galvanized Steel Strand. Low first cost, low maintenance expense are matters of record wherever this time-tested product is in use. Available in all standard grades and sizes from representative jobbers throughout the country. Or, write—

**INDIANA STEEL & WIRE CO.**
MUNCIE, : : INDIANA


tacts at its full rated current and voltage. This design of contact has been tested up to 170,000 kva. per pair of contacts without reaching the limit of its capacity; this is equivalent to a 3,000,000-kva. test on a 230-kv. breaker.

## Electric Cookery Sold Against Gas Competition

[*Continued from page 60*]

guarantees accurate size and greatly improves the product; a cream dispenser, which has resulted in improved service, and a butter cutter which provides 60 chips per pound.

By trial installation and thorough demonstration every item of the electric counter cooking equipment was proved profitable before decision was made for its purchase.

In December, 1939, it became necessary again to increase the customer's electric service facilities to 100 amp., due to the added counter cooking equipment.

Due to the increase in gross sales it was necessary to install a larger fry kettle. This new, 25-lb., 7-kw. kettle has greatly improved production and service, without any great increase in operating cost. The customer's used kettle was immediately sold and placed in operation at another location.

In this two-year period it has been necessary to service certain of this equipment. This has been done by the writer personally, but it is surprising the small amount of service and repairs required, considering the hard use and abuse given the equipment.

The customer is now discussing plans for additional remodeling to increase seating capacity and improve food service. Additional refrigeration equipment has been recommended, which will enable the customer to purchase foods in larger amounts, thereby further reducing food costs.

•

## Westinghouse School

More than 500 young high school graduates will receive training as skilled mechanics and machine operators this fall under an expanded trades education program of Westinghouse Electric & Manufacturing Co. The number of students normally enrolled in the company's four- and two-year training courses will be more than doubled.


## MAX-I-METER

## CUTS COSTS MANY WAYS

### *Operating company reduces transformer checking costs—*

Using the MAX-I-METER method, an operating company eliminated all overtime work in transformer load checking as the instruments could be removed and reinstalled during regular working hours. This cut the cost of the extra hours required in spot checking. A lineman and groundman with a MAX-I-METER can handle approximately eighteen new test installations per day.

### *Many operating companies now making savings*

To date 500 operating companies are using the MAX-I-METER method to keep up-to-date on their load situations at all times—to save investment and maintenance money—to keep the system clear of defective equipment—to use less transformer sizes to meet all loads—to keep down service interruptions.

***YOU CAN DO IT TOO***

All of these savings can be yours through the modern, dependable, MAX-I-METER method of knowing load values at all times. This light weight, weatherproof, maximum-demand ammeter combined with a multi-range split core current—4 ratios—clamps over the conductor.

***GET ALL THE FACTS***

Write today for the interesting details—learn why the MAX-I-METER, with accuracy to 3% plus or minus cuts costs many ways. It is not affected by ambient temperature. Can be readily reset and used immediately.

**HD ELECTRIC CO.**
100 W. MONROE ST. CHICAGO

# SEARCHLIGHT SECTION

## EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

UNDISPLAYED RATE:

10 cents a word, minimum charge $2.00.

*(See ¶ on box Numbers.)*

*Positions Wanted* (full or part-time salaried employment only), one-half the above rates.

*Proposals*, 50 cents a line an insertion.

INFORMATION:

*Box Numbers* in care of any of our New York, Chicago or San Francisco offices count 10 words additional in undisplayed ads.

*Discount* of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED—RATE PER INCH:

The advertising rate is $6.50 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

*An advertising inch* is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page. E.W.

*NEW ADVERTISEMENTS received by 10 A. M. September 30th will appear in the October 5th issue subject to limitations of space available*

## OFFICIAL PROPOSALS

Bids: September 24 (68)

### Power Substations

GRAND RIVER DAM AUTHORITY
Grand River Project—Pensacola Dam
CONTRACT 13-D—
RIVERBANK SUBSTATION EQUIPMENT
1940

Sealed bids will be opened by the Board of Directors of the Grand River Dam Authority in Vinita, Oklahoma, on the 24th day of September, 1940, at 10:00 o'clock A.M. for

Contract 13-D—the furnishing f.o.b. cars Riverbank Generating Station, Byllesby, Oklahoma, on the Frisco Railroad of

Section 1. One (1) 16,500-kva oil-immersed, self-cooling power transformer; high voltage, 110,000 volts; low voltage, 66,000 volts;

Section 2. One (1) 69,000-volt, 600-ampere, electrically-operated oil circuit breaker of 500,000-kva interrupting capacity.

Bids mays be tendered upon either or both sections of the work, and if both sections are bid, they may be bid jointly or separately.

Bids may be filed with the General Manager of the Authority at his office in the City Hall, Vinita, Oklahoma, up to 10:00 o'clock A.M. of said day, at which time they will be opened and publicly read at a meeting of the Board of Directors. Any bid received after the closing time (10:00 o'clock A.M.) will be returned unopened.

Specifications, Form of Contract and Bond, Requirements for Bidding and Proposal Form are on file and can be seen at the Office of the General Manager of the Authority, City Hall, Vinita, Oklahoma, and they can be obtained from the Office of Holway and Neuffer, Engineers, 302 East 18th Street, Tulsa, Oklahoma, or Holway and Neuffer, Engineers, Vinita, Oklahoma, on deposit of $10.00 of which amount $5.00 will be refunded upon return of plans and specifications in good condition within ten days after the award of the contract. No refund will be made after that date. The total amount of the deposit will be refunded to all bidders. All checks for these deposits shall be made out to Holway and Neuffer.

Each proposal must be accompanied by a certified or cashier's check on any solvent bank or trust company, payable without reserve to the Grand River Dam Authority, in an amount not less than five per cent (5%) of the total amount of the bid. If bids are held more than ten days any bidder may substitute a satisfactory Bidder's Bond for his check in the same amount, and thereupon his check will be returned to him. Checks or bid bonds of the three low bidders will be retained until approval of contract and execution of satisfactory bond by the successful bidder, or until other disposition of the bids is made.

The bond required will be a performance bond for the faithful performance of the work in the full amount of the contract.

All bids must be made on the proposal forms furnished by the Authority and must be in accordance with the "Requirements for Bidding and Instructions to Bidders."

No bid may be withdrawn for at least sixty (60) days after the scheduled closing time for receipt of bids.

If awarded, the work under this contract will be awarded to the lowest responsible bidder on each section or on the lowest combination of sections.

All work herein advertised is to be paid for by voucher upon claim approved by the Engineers.

The Authority may request every bidder, before his bid is considered for award, to file a statement of facts as to his previous experience in performing similar work of comparable magnitude, of his business and technical organization, and financial resources and plant available and to be used in performing the contemplated work. Each bidder must have such information, together with a recent financial statement, available at Vinita, Oklahoma, the day on which bids are to be received.

The Board of Directors reserves the right to reject any or all bids and to waive any informality in any bid.

Dated this 27th day of August, 1940.

GRAND RIVER DAM AUTHORITY
By: Ray McNaughton
Chairman, Board of Directors

Bids: September 24 (69)

### Substations

GRAND RIVER DAM AUTHORITY
GRAND RIVER PROJECT—
PENSACOLA DAM
CONTRACT 13-C—69-KV SUBSTATIONS
1940

Sealed bids will be opened by the Board of Directors of the Grand River Dam Authority in Vinita, Oklahoma, on the 24th day of September, 1940, at 10:00 o'clock A.M. for

Contract 13-C—the building of two complete 69-kv sub-stations, one at Collinsville and one at Chelsea, Oklahoma, and the furnishing and installation of certain equipment and the doing of certain work at the switchyard and power house at the Pensacola Dam on the Grand River in Northeastern Oklahoma.

Bids may be filed with the General Manager of the Authority at his office in the City Hall, Vinita, Oklahoma, up to 10:00 A.M. of said day, at which time they will be opened and publicly read at a meeting of the Board of Directors. Any bid received after the closing time (10:00 o'clock A.M.) will be returned unopened.

Plans, Specifications, Form of Contract and Bond, Requirements for Bidding, Proposal Form, and Construction Terms and Conditions are on file and can be seen at the Office of the General Manager of the Authority, City Hall, Vinita, Oklahoma, and they can be obtained from the Office of Holway and Neuffer, Engineers, 302 East 18th Street, Tulsa, Oklahoma, or Holway and Neuffer, Engineers, Vinita, Oklahoma, on deposit of $20.00 of which amount $10.00 will be refunded upon return of plans and specifications in good condition within ten days after the award of the contract. No refund will be made after that date. The total amount of the deposit will be refunded to all bidders. All checks for these deposits shall be made out to Holway and Neuffer.

Each proposal must be accompanied by a certified or cashier's check on any solvent bank or trust company, payable without reserve to the Grand River Dam Authority, in an amount not less than five per cent (5%) of the total amount of the bid. If bids are held more than ten days any bidder may substitute a satisfactory Bidder's Bond for his check in the same amount, and thereupon his check will be returned to him. Checks or bid bonds of the three low bidders will be retained until approval of contract and execution of satisfactory bond by the successful bidder, or until other disposition of the bids is made.

The bonds required will be a performance bond for the faithful performance of the work and a statutory bond for the protection of laborers and materialmen, both in the full amount of the contract.

All bids must be made on the proposal forms furnished by the Authority and must be in accordance with the "Requirements for Bidding and Instructoins to Bidders."

No bid may be withdrawn for at least sixty (60) days after the scheduled closing time for receipt of bids.

If awarded, the whole work under this contract will be awarded as one contract to the lowest responsible bidder.

All work herein advertised is to be paid for by voucher on estimates furnished by the Engineers.

Attention of the bidders is called to the Wage Scale as determined by the Authority and appearing in the "Construction Terms and Conditions."

The Authority will request every bidder, before his bid is considered for award, to file a statement of facts as to his previous experience in performing similar work of comparable magnitude, of his business and technical organization, and financial resources and plant available and to be used in performing the contemplated work. Each bidder must have such information, together with a recent financial statement, available at Vinita, Oklahoma, the day on which bids are to be received.

The Board of Directors reserves the right to reject any or all bids and to waive any informality in any bid.

Dated this 27th day of August, 1940.

GRAND RIVER DAM AUTHORITY
By: Ray McNaughton
Chairman, Board of Directors

Bids: October 1 (70)

### Kitchen Gas Ranges, Automatic Refrigerators

The Great Falls Housing Authority will receive sealed bids for the furnishing only, on the site, of one hundred and fifty-seven (157) kitchen gas ranges and/or one hundred fifty-seven (157) automatic refrigerators for Parkdale Project No. MONT. 2-1 located in Great Falls, Montana, until 12 o'clock noon MST on the first day of October, 1940, at the office of the City Clerk located in the Civic Center Building, Great Falls, Montana. Bids will be publicly opened and read aloud in the City Council Chamber, City Hall, at 2:00 P.M. MST., of the same day.

The successful bidder will be required to furnish a satisfactory performance bond.

Proposed forms of contract documents and specifications will be on file after September 9th, 1940, at the office of the Great Falls Housing Authority, Paris Building, and will be ready for issuance at the same time at the office of the Architect, A. V. McIver, 512 Strain Building, Great Falls, Montana.

Copies of the documents may be obtained from the Architect by depositing $10.00 for each set of documents for furnishing ranges and refrigerators. Deposits shall be in the form of a certified check made out to the Architect. The amount of the deposit will be refunded upon the return of the specifications in good condition within 10 days after the opening of bids.

The Great Falls Housing Authority reserves the right to reject any or all bids, to waive any informalities in bidding, and to evaluate the bids in the manner specified.

A certified check or bank draft payable to the Great Falls Housing Authority, U. S. Government Bonds (at par value), or a satisfactory bid bond executed by the bidder and a surety company, in an amount of five percentum (5%) of the bid shall be submitted with each bid.

No bid shall be withdrawn for a period of sixty (60) days subsequent to the opening of bids without the consent of the Great Falls Housing Authority.

Great Falls Housing Authority,
By R. H. WILLCOMB,
Executive Director

September 9th, 1940.
Date of First Publication.